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EDITORIALS

THE VALUE OF A REPUTATION.

The electrical contractor who figures his bids just as close to the line as possible and then puts in as poor a job as will pass inspection, sometimes finds that new work becomes increasingly difficult to get. Then he may conclude that the decision goes against him on account of price, and may cut still further into figures which were already too low to warrant first-class work. The likelihood is, however, that he is reaping the natural results of a policy that sometimes leads to temporary success, but seldom places an individual or a company in a position to build up an increasing business and be looked upon favorably in the community by those who want good installations made and would rather pay for them than to take chances with the contractor who has achieved a reputation for work of a lower order.

In establishing a business upon a solid foundation, the contractor should provide a complete and thorough system of accounts, and know just what his work is costing him. He can then tackle new business upon an intelligent basis. Collections should be closely looked after, so as to avoid interest charges and losses. The latter are one of the elements of overhead expense, and the less time and effort put into collections will tell in the general costs of operating the business. Advertising should be indulged in discreetly, and should be used to tell the public about good work and good materials.

With all of these elements contributing to success, the final contribution consists in making the advertising claims true, that is, in establishing a reputation for doing dependable work—work that will not only pass inspection, but will stand the test of time, prove satisfactory to the user, and carry with it a recommendation for future orders. It takes time to build up a reputation for first-class work that is of value, but when this reputation is once established it is the most valuable asset that a contractor can possess. It carries with it a modicum of good will, and brings in future orders at profitable prices that no amount of price-cutting could attract.

Of course it is assumed in the above that the contractor knows his business and is carrying it on with reasonable efficiency. Without these elements he can never establish an enviable reputation. But with them, and with a record for honesty and integrity and high-grade work, he can establish a standing in the community that is worth something.

TAKING THE BLAME.

The handling of complaints is one of the most difficult, and at the same time most important functions which the management of a central-station company has to perform. It is at this point of public contact that diplomacy and tact of the highest order are demanded.

The complaint bureau is the dissecting room of a public utility; here the very nerve fibers of its organism are laid bare and come under the touch of the public's none too tender hands. How to meet the criticisms and complaints, to which even the best operated service is subjected, is a most vital concern.

A holding company which controls a score of utilities in various parts of the country advises its local managers to assume personally the brunt of criticisms directed at the companies under their direction. It is urged that this policy lessens the difficulty of adjustments. If responsibility is allowed to rest on the company or its whole organization, it urges, the tendency is to aggravate the already too great proclivity to regard a corporation as a creature with little sensibility.

By associating his own personality with the individuality of the company, a local manager can cause the utility to be looked upon as any other business; that is, as an enterprise with a human head to it, and a directing management whose policies and actions are subject to discussion and explanation by the one who takes responsibility for them.

Many complaints, of course, arise from the failure of employees to perfectly carry out their duties. Mistakes are bound to occur and omissions may be sometimes in evidence, and the best policy is to acknowledge their existence, assume responsibility, make any amends possible and assure no repetitions in the future. While the company thus stands before the public as a unit, each department should be strictly held to account for its own delinquencies, and urged to so perfect its organization as to make the mistakes and oversights as few as possible. The acknowledgement to the customer of an error which all recognize as human will often make a friend, when an attempt to evade or slight responsibility will only cause dissatisfaction and animosity.

In adjusting such difficulties as fall to the lot of every light and power company, it is well to let the customer see into the inner workings sufficiently to know just how the trouble came about. In many cases, the difficulty, especially the sort that attends the mechanical division of the business, is readily shown to be

beyond human control or anticipation. For example, reasonable customers will recognize that most line trouble would be obviated were the undergrounding of all wires feasible and not involving vast investment which would result in higher rates.

VALUATION ON THE BASIS OF ACTUAL PERFORMANCE.

The Washington Public Service Commission has handed down an interesting opinion in the case of the Pacific Telephone & Telegraph Company, stipulating the basis for valuation in connection with an investigation of the rates of that company. The decision recognizes the court dicta which require the present fair value of the useful property of the utility corporation to be considered in determining rates. It points out that no definition as to what constitutes a fair value has ever been laid down, however. It calls attention to the fact that in the ordinary sense of the word "fair value" or present market value itself depends to a certain extent upon existing rates and also depends upon acts on the part of the public that may have lent value to the utility property. Although the reproduction method was used by the staff of the Commission in carrying out an appraisal, the result was discarded for a valuation on an "actual-performance" basis.

The respondent company itself favored the latter method, recognizing that such added value as has come to its property without effort on its part is the result of developments over which it had no control and for which it does not care to penalize the public. Figures were submitted by the utility company which the Commission has accepted as constituting a definite and proper basis for rates. The Commission makes the following statement: "We, therefore, adopt and approve the plan suggested by respondent that rates are to be based upon facts rather than theories; that fair value, if the words are to be used in their usual and ordinary sense, cannot be the basis for rates; that a utility is entitled to reasonable compensation based upon the reasonable and necessary detriment suffered in preparation for and in the service of its patrons, and not upon values created by the public. * * * * * These 'actual-performance' records, therefore, wherever they can be obtained should be the storehouse from whence is drawn the fact upon which is based the actual, reasonable and necessary detriment suffered by the utility in serving the public, and whatever that detriment may be, the public, in justice and equity, should return fair compensation upon that sum."

The Commission states that no case has ever before been submitted to it or to any other Commission upon this basis. It considers this, however, the only proper method of determining valuation, omitting all elements of increment in value such as have arisen from increased population, paving over mains, etc.; but an allowance is made for development costs, since it is recognized that in building up a business of this kind there are usually periods of loss before the business is placed upon a paying basis.

A SIGNIFICANT RATE INCREASE.

An increase in both lighting and power rates in the municipal lighting plant of the large town of Westfield, Mass., which took effect August 1, suggests the question whether in some cases at least, an end has not been reached in the progress of price reductions toward the irreducible minimum. The Westfield increase appears due to the increasing cost of labor and materials. The town plant serves a manufacturing and residential community at the foot of the celebrated Berkshire Hills, and has been managed along modern lines for some time, with an energetic policy on behalf of new power business and the application of present-day ideas to station engineering practice.

The new lighting rate represents an advance from a former charge of 7 cents per kilowatt-hour to 9 cents, and the power rates have likewise been increased from a maximum of 4 cents to a new maximum of 5.25 cents, and from a minimum of 2 cents to a new minimum of 2.5 cents. In a recent notice in the Springfield, (Mass.) *Republican,* the statement was made that the lighting department commissioners hope soon to be able to reduce the above prices again, but that they cannot combat the present high cost of supplies and labor on the old basis.

An interesting feature of the situation which has not received much attention in the press at this time is the possibility of securing additional economy of operation through the purchase of hydroelectric energy from one of the large New England companies operating in the Connecticut Valley. Some time since, representatives of the Turners Falls Power & Electric Company endeavored to negotiate a power contract with the town, but the voters decided against the plan, preferring to develop their own steam plant to meet increasing business demands. The necessity for increasing rates now throws open the whole question again, in a broad sense, and it will be surprising if further efforts to give the town the benefits of low-cost hydroelectric service do not soon follow. It would seem that here is a case where the well known advantages of combining load-factors to utilize plant investments most effectively might be enjoyed by the various parties in interest.

The still larger question of rate standardization is of special interest at this time. Central stations have been cutting down rates for many years as the volume of their business has increased, and it is certainly one of the legitimate boasts of the industry that electricity has been growing cheaper in the face of advances in the cost of nearly every other commodity during the past quarter-century. The street railways appear to have reached the limit of their services on a five-cent fare, in many cases, and is the central station to be confronted with a similar problem? This question cannot be answered off-hand, perhaps, but it is entirely within the possibilities that the time may be in sight when some plants of moderate size must call a halt on further cuts in rates, if actual steps toward higher prices be not in immediate prospect.

Already in the great metropolitan stations using very

high powered turbo-units, the cost of production is becoming relatively less a matter of fuel and labor than of fixed charges, and the cost to the consumer involves more for distribution than for generation of energy. This suggests service on a flat rate determined by the demand or readiness-to-serve charge. Just how much lower even large central stations will be able to carry their rates depends upon the possible volume of future business which can be secured, taking into account load-factor development and the diversity of different loads. The question must be settled for each plant in turn, and there is nothing sacred about rates which have tended downward for long periods, provided the cost of service turns upward beyond control of the utility manager. Future prices must be adjusted according to such costs. Raising rates is always an unpopular task, and in a municipal plant such a course may lead to political eventualities; but in some cases, apparently, such action must be taken if satisfactory service is to be rendered. The big companies are not at present face to face with this problem to any extent, so far as we are aware, but it will pay to keep a sharper eye than ever on costs in view of the experience of the Westfield management.

CONTRACTOR AND ARCHITECT.

The installation of electrical equipment in a modern building of any size is one of the most important elements in the satisfactory and comfortable use of that building. The use of electric lighting, telephones, signal equipment, and motors for elevators, fans and other applications are considered essential in the office, store, factory, hotel, residence, theater or building for public use. The electric wiring is just as essential as the plumbing, the decorating, the furnishing, or any other supplement to the building itself. Yet how seldom is the name of the electrical contractor connected in any way with a large and important building, or even known to anyone but those he actually transacts business with? This condition is largely due to the unimportant part which the electrical contractor has usually occupied in the planning of electrical features and the negotiations for the work. He is usually not consulted in laying out the work, and the contract is usually sub-let by the general contractor. Both of these conditions are undesirable.

The architect and the general contractor have in the past usually ignored the electrical contractor until the time arrived for the latter to bid on the work, and then the amount of his bid was the only feature of interest about him. This has been partly due to the fact that the average electrical contractor was only concerned in the mechanical end of the installation work and was not prepared to offer any advice or suggestions as to plans and specifications. Today, however, many contractors are giving close study and attention to the requirements of their work, and architects and engineers might receive valuable aid in planning the electrical equipment by taking the electrical contractor into their confidence. The result might be a cheaper installation or one better fitted to meet the exactions of future requirements. The direct contact of architect or owner with the electrical contractor, instead of through a general contractor, would also be of advantage to both parties.

Architects sometimes come to a realization of the advantages of conferring with the electrical contractor when it is too late. The time to consider changes in the wiring plans is not when the structure is half built, but when the general plans are undergoing evolution. Electrical requirements should receive early consideration, and building plans should be worked out with these requirements and the means for their fulfillment in mind. Only in this way can the best electrical service be secured on the most economical basis.

In the letting of contracts, the electrical contractor should be upon the same basis as the general contractor and the plumbing contractor. The only reason why an architect should prefer to include the electrical work in the general contract is to save himself trouble. In accomplishing this purpose he insures an extra profit to the general contractor, and a job that will be done in the cheapest way possible, neither of which is especially in the interest of the owner of the building, whose interests the architect is supposed to be protecting.

MEETING GENERAL COMPETITION.

Probably a large majority of electrical contractors carry supplies of electrical equipment for sale and many of them also have stocks of appliances and lighting fixtures. This is especially true in the smaller cities, where the contractor aims to be the electrical headquarters of the community and supply all electrical needs. Too often, however, the contractor has had little training or experience as a merchant, and fails to meet all the requirements of successful merchandising.

It is highly desirable, however, that the electrical dealer should keep this trade in his own hands and not let it pass to the department store, the plumber, the hardware merchant, or other agency poorly informed as to electrical requirements. Electrical goods should, for the good of the industry and the public, be handled by those familiar with electrical conditions. The article by Mr. Gordon C. Keith in this issue contains some valuable suggestions for the electrical dealer as to how to meet such competition, which exists everywhere in either an active or potential form, and which is more likely to spring up as the use of electrical appliances becomes more and more general. By adopting enterprising and modern merchandising methods and properly serving this trade there is no good reason why it should not be held by the purely electrical dealer who specializes in this line, for he can offer a service which is always lacking where other merchants attempt to handle such goods. The expert knowledge of the specialist is peculiarly valuable in reference to electrical merchandise.

Happenings in the Industry

Union Electric Company, of Dubuque, Iowa, Sold—New Street-Lighting Installation at Trenton—Increase of Central-Station Members in Society for Electrical Development—Hot Weather of Last Two Weeks Causes Fan Sales to Establish New Record—New Jersey Electric Companies Combine—Miscellaneous News Notes

Plant of the Union Electric Company at Dubuque Is Sold.

The purchase of the holdings of the Union Electric Company, of Dubuque, Iowa, by the Dubuque Electric Company has been announced, the deal involving approximately $3,000,000.

The principal holders of the stock of the Union Electric Company were Frank D. Stout, formerly of Dubuque but now residing in Chicago, Ill.; D. D. Myers, W. J. Brown and John Ellwanger, of Dubuque. The Dubuque Electric Company is controlled by Elston, Clifford & Company, of Chicago, who also control the Northern Iowa Gas & Electric Company, which operates in a number of cities in Northwestern Iowa, and the Vicksburg (Miss.) Light & Traction Company.

The Union Electric Company was organized about 25 years ago for the purpose of consolidating a number of street-car and electric interests in Dubuque, all small and having conflicting interests. The consolidation resulted in many changes and the betterment of the electric and street-car service of the city. Among the men who have had the management of the company's property are Mr. Dame, who had charge during the organization period. He was followed by L. D. Mathes, who made a large number of extensions and improvements. In 1912 E. M. Walker, formerly of Muscatine, Iowa, was appointed manager, and since that time two important street-car line extensions have been made, and the capacity of the company's power plant has been more than doubled. It is understood Mr. Walker will remain as general manager of the plant.

A New Method of Flag Illumination.

Perhaps one of the most novel illuminations of "Old Glory" at night is found in a residence of a citizen of Schenectady, N. Y. The scheme of light projection on a roof has already proven successful, but in certain instances it is not feasible.

The apparatus in this instance is simple and inexpensive. The flag measures five by eight feet and is suspended in front of the house from a staff projecting from an attic window. On the roof of the piazza below are mounted two 60-watt Mazada lamps and reflectors. These lamps are not discernible from the street and the rays are directed on the flag from both sides at an angle. Energy is obtained from an ordinary lamp socket in one of the nearby rooms.

The effect is said to be strikingly beautiful, every ripple of the flag standing out in vivid contrast with the surrounding darkness. The colors are strongly emphasized by the artificial light. The possibilitties of this form of illumination of the American flag throughout the country are great, the trouble and expense involved being very small.

New Street Lighting for Trenton, N. J.

The city of Trenton, N. J., is considering the installation of an improved system of street lighting by means of nitrogen-filled incandescent lamps; posts, lamps and equipment to be provided by the Public Service Electric Company, which also furnishes energy for lighting the city.

It is proposed to install 298 600-candlepower type C Mazda lamps in round magnetite arc type lanterns on 12-foot iron poles, and in addition four units of 200 and four of 100 candlepower, on the following principal business streets: from the Pennsylvania Railroad Station, on South Clinton Avenue, to State Street; west on State to the Capitol; Broad Street from Battle Monument south to Greenwood Avenue, and on Warren Street from the monument south to Lafayette Street.

The new lamps are to replace 15 arcs, four 1,000-candlepower type C incandescents, 62 600-candlepower type C, three gas lights and four 200-candlepower tungstens. If the present plan is carried out the new units will be located opposite one another, 75 to 100 feet apart on the curb line. This close spacing will insure abundant street and sidewalk lighting, but there is some feeling that posts only 12 feet high will make for troublesome glare in the eyes of drivers of vehicles, and that 14-foot posts would be better practice.

The rates which the city will pay are not yet announced.

Steady Increase of Central-Station Members in Society for Electrical Development.

As an indication of the increased interest evinced by central stations in the work of the Society for Electrical Development, it is interesting to note that recently 141 central stations have become members. The increased membership is representative of all parts of the country and includes as well, the subsidiary companies of four important holding companies.

The Society is rendering valuable sales service to the lighting companies especially as regards electric-range campaigns and special advertising services. It is announced that the Society now has on file complete records of rates in 3,250 communities which quote a five-cent rate or under for heating and cooking. Of this number about 70 per cent are four-cent rates and under and 30 per cent are three-cent rates and under. This information service has been particularly valuable to central stations planning electric-range and heating campaigns.

Central stations everywhere are becoming more active supporters of the Society in every way. Hundreds of prominent executives have accepted appointments as chairmen of "America's Electrical Week" local committees. It is quite apparent that the big 1916 campaign will have the support of the central-station industry as a whole. It is expected to be very productive in increasing the membership of the Society.

Mobile Company Does Fast Work Restoring Service After Storm.

Promptness marked the work of the plant department of the Mobile (Ala.) Electric Company in repairing the damage caused by the storm during the middle of July. Fifty linemen and a large number of groundmen were placed at work and all circuits within the central section were restored within a few days. Suburban sections required several days longer. Street-lighting circuits received the greatest damage. The local newspapers gave the railway company considerable praise for the quickness with which adverse conditions were attacked.

FAN SALES SET RECORD.

Reports from Leading Jobbers and Dealers Indicate Greatest Fan Season in History of Industry.

An unprecedented demand for electric fans was experienced by jobbers and dealers throughout the country during the July "hot spell". Reports from different sections of the country indicate that the sales were extremely heavy and that many stocks were virtually cleaned out. In some cases not only the 1916 stocks were sold but fans carried over from 1914 and 1915 were disposed of to very willing purchasers.

The electric fan is fast ceasing to be merely a convenience, and is becoming a necessity. More and more business houses are realizing the need of fans as an aid to efficiency of employees, householders are becoming more keen to the utility and comfort of a fan, and in the sick room they are indispensable. The hot spell proved a quickener to these realizations.

The following reports from jobbers and dealers give some figures on sales during July and serve as an indication of how stocks have been depleted throughout the entire country.

American Electrical Supply Company of Chicago, Ill., estimates its sales at 3,000 fans during the last two weeks of July.

Manhattan Electrical Supply Company reports through its Chicago office that the demand for fans since July 15 has been greater than for any like period of any year. The sales during the past two weeks are estimated to be in excess of those during the entire year of 1915. The demand is considered a healthy change in public sentiment, and indicates that fans are no longer a seasonable article, to be purchased before July 4 or not at all. They are now being properly considered as a permanent investment that may be made at any time during the summer.

The B.-R. Electric & Telephone Manufacturing Company, of Kansas City, Mo., states that its fan sales are 150 per cent ahead of last season's sales, the sales to July 1 being equal to the total sales last season, and the sales during July being double those to July 1.

Central Telephone & Electric Company, of St. Louis, Mo., reports that on July 3 the company sold the largest number of fans it ever disposed of in a single day, and that its July business has been in keeping with that record. Stocks of fans in dealers', jobbers' and manufacturers' hands in St. Louis are practically exhausted and there are no job lots left on the market or old styles at cut prices. This means that in 1917 new types only will be offered and the condition of the market will be like starting a new business. The company's 1914 fan sales were very large, but in 1915 sales were one-half of those of the previous year. Purchases during th early part of 1916 were light because of stock carried over, and on July 1 the company considered the 1916 fan business at an end. The hot spell changed conditions very materially.

The Monarch Electric & Wire Company, of Chicago, estimates its sales during the latter part of July at 2,300 fans.

Commonwealth Edison Company, of Chicago, reports the sale of over 1,200 fans in its electric shops and branch stores during the last week of July.

Harry I. Wood Company, of Louisville, Ky., states that its fan sales this season were doubled, as compared with those of last year.

Sterling Electric Company, of Minneapolis, Minn., sold three times as many fans as in any previous season, the majority being retailed.

Northern Electric Company, of Minneapolis, Minn., states that its sales this season have been quadrupled, and that many more could have been sold if it had been possible to secure them.

Northwestern Electric Equipment Company, of St. Paul, Minn., reports an increase of 150 per cent in fan sales, as compared with 1915.

The Public Service Electric Company's office in Trenton, N. J., made the largest turnover of fans of any year in its history, sales exceeding by 100 per cent those of 1915. The first day of the July "hot spell" all the tables in the large show room were cleared of various devices and about 35 fans were set up, connected and placed in operation. The unusual display effected a large number of sales.

New Freight Rates for Electrical Goods.

Under the decision of the Interstate Commerce Commission in the case of the Benjamin Electric Manufacturing Company (Chicago) vs. the Atchison, Topeka & Santa Fe Railway Company, et al., the carriers in Western Classification territory will have until September 1 to amend their tariffs so as to maintain ratings applicable to the interstate shipment of electric light or lamp reflectors made of enameled iron, steel, or tin, nested solid or nested but not solid, in boxes or barrels, less-than-carloads, no higher than the ratings contemporaneously in effect on sheet-iron enameled ware. Heretofore they have taken a rate of first class when packed in barrels or boxes, and of one and one-half times first class when packed in crates. They will now take rates of third class when nested solid and of second class when only partly nested. In this connection the Commission holds, in part, as follows: "The diversity disclosed in the values, shapes, weights, etc., of enameled reflectors renders it impracticable to distinguish between them for classification purposes, and their similarity to enameled ware, in composition, range of values, and other characteristics, renders it inconsistent to rate them differently from such articles."

Electrical Interests at Rotary Convention.

The various branches of the electrical trades were well represented at the convention of the International Association of Rotary Clubs, held in Cincinnati, O., July 16-20. The light and power section, of which W. W. Freeman, president of the Union Gas & Electric Company, is the Cincinnati member, had an attendance of about 25, with W. R. Power, of Huntington, W. Va., as chairman. The division of electrical supplies and construction, with L. E. Reid, of St. Joseph, Mo., as chairman, and F. D. VanWinkle, of the DeVere Electric Company, as Cincinnati member, had over 30 members registered. Dealers in lighting fixtures were also represented, with Frank Brezeczkowski, of Chicago, as chairman of the section, and C. D. Corbus, Cincinnati member, as vice-chairman. Each section held a meeting of its own on Tuesday afternoon, July 18, nearly 200 separate meetings of this sort being held, indicative of the wide scope of the Rotary Clubs in the matter of the business interests represented. About 5,000 persons attended the convention.

New Jersey Electric Companies Combine.

The New Jersey Public Utility Commission has approved the merging of five corporations into the Electric Company of New Jersey, and has granted them authority to issue capital stock to the extent of $157,000 through the new concern. The companies merged are the Penns Grove Electric Light, Heat & Power Company, Clementon Township United Electric Improvement Company, the Williamstown Electric Company, Woodstown Ice & Cold Storage Company, and the Electric Company of New Jersey. At the same time the board granted the American Railway Company permission to purchase the capital stock of the Electric Company of New Jersey, not exceeding 1,575 shares, as well as the bonds or other obligations of the concern merged with this company.

ENGINEERING ECONOMICS AND THE SMALL PLANT.

How One Utility Reduced Its Transformer Investment and Core Losses to One-Half.

By P. J. Nilsen.

There has from time to time appeared in these columns articles on the construction and operation of isolated electric light utilities operating in towns of one thousand people or less. The condition that has brought these small plants into the limelight has usually been some very commendable, ingenious but uncommon, feature of design, construction or operation. The writer has occasion to keep in more or less intimate contact, both in an advisory and supervisory capacity, with some forty electric light utilities in the Middle West. Sixteen of these utilities were communities of one thousand inhabitants or less. His experience with these sixteen leads him to believe that these accounts of good engineering practice are not representative of the condition of the large number of small isolated plants scattered over the country. They represent the exception rather than the rule.

Usually the profits of these small plants—when there are any profits—are very meager. This condition can ordinarily be attributed to poor management due to an absolute lack of technical knowledge, and sometimes to a lack of good common horse sense. Frequently different losses in the system are so great that they eat up the profits and the owner is unaware of anything wrong except the fact that he is not making any money. It is the purpose of these words, by treating a concrete case, to draw the attention of owners of small plants to some of these losses with the hope that they may profit by the example.

Recently the writer was asked by a small utility to investigate a condition where the unaccounted-for losses were equal to one-half of the total amount of energy sold. The utility in question is operating in a town of 800 inhabitants. Energy is purchased at 13,200 volts for 6.5 cents per kilowatt-hour. A 50-kilowatt outdoor transformer substation reduces the voltage to 2,300 for distribution to the following lighting load:

TABLE I.

Transformer number	1	2	3	4	5	Total
Rating in kilowatts	5	10	3	3	5	26
Connected load—						
Residences	6.48	9.92	6.17	10.15	0	32.72
Stores	6.00	0	5.50	0	0	11.5
Streets	0	0	0	0	4.8	4.8
Total	12.48	9.92	11.67	10.15	4.8	49.02

Even a casual study of this table reveals the fact that the transformer capacity is entirely out of proportion to the connected load. It will be seen that the substation transformer capacity is twice as large as the distribution transformer capacity and larger than the connected load, which is absurd. It is at once apparent that here are some unnecessary losses and some extravagant investment in transformers.

For a 53-day period during the winter it was found that the energy purchased was 2,500 kilowatt-hours, while the energy sold was only 1,600 kilowatt-hours, leaving 900 kilowatt-hours unaccounted for. The company refused to pay the bill for the purchased power, claiming that the totalizing meter was "way fast." The meter was accordingly tested and, much to the chagrin of the utility, found to be one per cent slow. One of the directors of the company was quite sure that he had discovered the clue to this mysterious, ever present loss when he noticed that the transmission line wires were not insulated. He was sure that the current was leaking out into the air.

A few simple calculations soon revealed the fact that the sum of the transformer core losses and the meter potential-coil losses for the 53-day period amounted to 738 kilowatt-hours. This left only 162 kilowatt-hours unaccounted for, and this was probably losses in the transmission and distribution line wires which were not estimated. It was a simple matter to show the company how a saving in both operating costs and transformer investment could be effected by decreasing the sizes of the transformers as follows:

TABLE II.

	Residences	Stores
Consumers' demand-factor	0.45	0.75
Reciprocal of group diversity-factor—		
Consumer to transformer	0.28	0.65
Between stores and residences	0.85	
Transformer to substation	0.75	

Applying these demand and diversity-factors to the connected load, shown in Table I, gives the results shown in Table III.

TABLE III.

Transformer Number.	Simultaneous Demand. Kilowatt.	Rating. Present. Kilowatt	Proposed. Kilowatt.	Yearly saving in Core Losses.	Saving in Investment.
1	3.18	5	3	$5.12 or 21 per cent	$27.00 or 44 per cent
2	1.25	10	7.5*	6.27 or 16 per cent	12.25 or 16 per cent
3	3.03	3	3	None	None
4	1.28	3	1.5	6.27 or 32 per cent	10.20 or 29 per cent
5	4.8	5	5	None	None
Sub-station	11.35	50	15	81.10 or 70 per cent	165.68 or 61 per cent
Total		76	35	98.76 or 42 per cent	215.13 or 40 per cent

* A 7.5-kilowatt transformer provided here to take care of a possible 7.5-horsepower day load. Not necessary to provide for future growth.

It will be seen from this table that the proposed change will result in a decrease in transformer rating from 76 to 35 kilowatts, or 54 per cent. This represents a saving of forty per cent in transformer investment. The change will also result in a decrease of 42 per cent in cores losses or, at 6.5 cents per kilowatt-hour, $98.76 per year. This change will be made just as soon as a purchaser can be found for the transformers to be salvaged. The substation core loss could be further reduced by using a 10-kilowatt transformer from April 1 to October 1, adding a 5-kilowatt unit for the winter load. The increase in investment and attendance, however, offsets the saving in core loss.

The situation described above is not an unusual one. Every central station has its own special conditions and peculiarities, which may be such that the above case may not apply to them directly. Nevertheless, all have losses, some of which are avoidable, others unavoidable. Many of these losses are very considerable and may determine whether the balance goes on the debit or the credit side at the end of the year. In nearly every case these losses may be reduced, sometimes, as in the above case, very materially. Utilities will find that any time an effort devoted to investigating wasted kilowatt-hours, or other losses, will be profitably spent. It is the hope of the writer that these remarks may lead some of the small utilities to look into their losses to the end that they may be reduced both in numbers and in magnitude and thereby diminish the constant leaks that eat up the profits of the little fellows.

Louisville Industrial Campaign to be Inaugurated.

A fund in excess of $1,000,000 which the Louisville Industrial Foundation will administer in efforts to obtain new manufacturing establishments for Louisville is an assured fact, the nine-day campaign conducted by leading business men having seen the fund oversubscribed. The Louisville Gas & Electric Company stands to be one of the larger beneficiaries through increased power sale, but that company has more than done its part in the campaign. It made a contribution of $25,000, while the officials and department heads of the company also made personal subscriptions which will increase the total by a large amount. Besides that representatives of the company gave freely of their time during the campaign, there being ten men busily engaged in the canvass.

Miscellaneous NEWS NOTES

May Electrify Nickel Plate Railroad.—It is reported that under the guidance of the new interests the Nickel Plate Railroad is to undergo changes in the policy and management of the company. One important development is the appearance of a report that the Nickel Plate is to be electrified between Buffalo and Chicago, a distance of 525 miles. Terminal improvements also are to be made.

Utility Company Gives Midnight Dinner.—The Laurel Light & Railway Company, Laurel, Miss., gave its annual dinner to its employees on the night of July 4-5, at 1 o'clock in the morning, that being the only available time for bringing the men together. Newton Holifield, superintendent of the company, presided. All power and railway employees attended the dinner.

Municipal Ownership Defeated at Coeur d' Alene.—By a vote of 437 to 306 a proposal to issue $280,000 in bonds for the establishment of a light and water plant at Coeur d'Alene, Idaho, was defeated at a special election, held July 28. The City Council passed a resolution that none but taxpayers should be allowed to vote on the proposition and each voter was required to take an oath that he owned property in the city.

To Celebrate Installation of White-Way System at Peru.—On August 14 the city of Peru, Ind., will celebrate the illumination of Broadway with high-candlepower, nitrogen-filled, 6.6-ampere lamps installed in pairs on trolley-pole brackets on both sides of the street, 53 in all. The celebration will mark the beginning of the Maimi County Centennial Celebration Week.

Severe Electric Storms in Ohio Valley.—A series of severe electric storms has been recorded in the last two or three weeks in the Louisville section of the Ohio Valley, with attendant loss of life and damage to property, most of the storms being accompanied by high winds and downpours. The power plant of the Madison (Ind.) Light & Railroad Company was out of commission for several hours and many smaller places in all parts of the section were in darkness for hours due to breakage of wire systems.

Copper Oxide Electrically Sensitive to Light.—At the June meeting of the New York Electrical Society a paper was read by Theodore W. Case, telling of experiments on the action of light on oxidized copper. If two copper wires or plates are oxidized and immersed in an electrolyte, a galvanometer connected between them will be deflected when light falls upon one wire or plate. The voltage observed was about 0.1 volt. The current obtainable depends upon the area of the plates and approximated 0.2 ampere. Many variations of the experiment were described.

Trenton to Have Big Electric Sign.—The Ad-Craft Club, Trenton, N. J., is having an electric sign designed for installation on a bridge crossing the Delaware River. The sign will be erected by the R. C. Maxwell Company and will be 318 feet long, with letters 10 feet high, reading "The World Takes—Trenton Makes." The sign is estimated to cost $175 for maintenance and about $525 a year for lamp renewals.

New Jersey Corporation to Double Amount of Capital Stock.—The stockholders of the Public Service Corporation of New Jersey have voted to increase its capital stock, as recommended by the directors, from $25,000,000 to $50,000,000. It has been voted to place the stock on an eight-per-cent basis. Heretofore it has been on a seven-per-cent basis. The corporation has as its subsidiaries the Public Service Electric Company, the Public Service Gas Company and a traction system covering a large part of northern New Jersey.

Flag Raising at Danbury.—The raising of a large American flag at the lighting plant of the Danbury (Conn.) Bethel Gas & Electric Company recently was made the occasion of a civic celebration. C. H. Merritt, president and general manager of the company, presented the booster's club with the flag, and afterward athletic sports were held and a demonstration given of the methods of rescuing a lineman shocked by live wires.

Power Company Merger.—Six electric light and power companies operating in Lebanon County, Pa., have been merged into a new company to be known as the Weimer Electric Light & Power Company, Lebanon, Pa., in accord with permission of the Public Service Commission. The companies absorbed are the Cornwall, West Cornell, South Annville, South Londonberry, Mt. Gretna and Rexmont Light & Power Companies. P. L. Weimar is president and A. A. Weimar treasurer and secretary of the new organization.

Denver Company Gives Electric Flag to City.—The Denver (Colo.) Gas & Electric Company has donated a large electric United States flag to the city. The flag has been placed on the top of the band stand at City Park, and it adds very much to the lighting arrangement of that part of the park. The programs given out at the park each night mention the fact that the electric company presented the flag to the city. Since the preparedness idea took hold of the people the company has been making a successful campaign for the placing of electric flags on business houses and public buildings.

Electrical Manufacturers' Council Meets.—The Electrical Manufacturers Council, which is composed of a delegation of four members each from the Electrical Manufacturers Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies, held a very interesting meeting on July 17 in New York City. Many matters of importance to the associations represented, and to the industry at large, were considered. The Council held another meeting on July 26 in New York City.

Object to 25-Cycle Current.—Complaint has been filed with the Pennsylvania Public Service Commission against the Newmanstown Electric Light & Power Company by two citizens of Schaefferstown. The service is alleged to be both dangerous and unsatisfactory, since a change was made recently in the management of the electric light company, which is now furnishing 220-volt, 25-cycle current for lighting purposes, with the result that there is a "constant flickering and fluctuating of lights, making it impossible to use for reading purposes and comfort."

Denver Theater Well Illuminated.—The new Rialto moving-picture theater on Curtis Street, Denver, Colo., is a notable example of electrical illumination. The outside lighting is an important feature, as it embraces 2,564 incandescent lamps, giving a light of 82,250 candlepower, or 7,250 candlepower more than the illumination of the Denver Gas & Electric Light Company's building. The interior is lighted with 800 incandescent bulbs and the devices for diffused illumination when the films are being shown are complete and ingenius. The theater will seat 1,200 persons.

Toledo Sets "Daylite" Record.—The new-business department of the Toledo Railway & Light Company, operated by Henry L. Doherty & Company, set a new month's record for the sale of "Daylite" lamps during June, the figures being 2,150 lamp sales at $4,160, which was an increased wattage of 132,720. A. K. Young, new-business manager, states that the sales could have been doubled if deliveries had been assured. One salesman sold 686 lamps, which increased the wattage 37,860, while another was a close second with 590 lamps, an increased wattage of 37,960.

Motor Equipments for Petroleum Recovery

A Paper on the Work of Induction Motors in Drilling, Pumping and Cleaning Oil Wells, Presented at the Recent Convention of the American Institute of Electrical Engineers

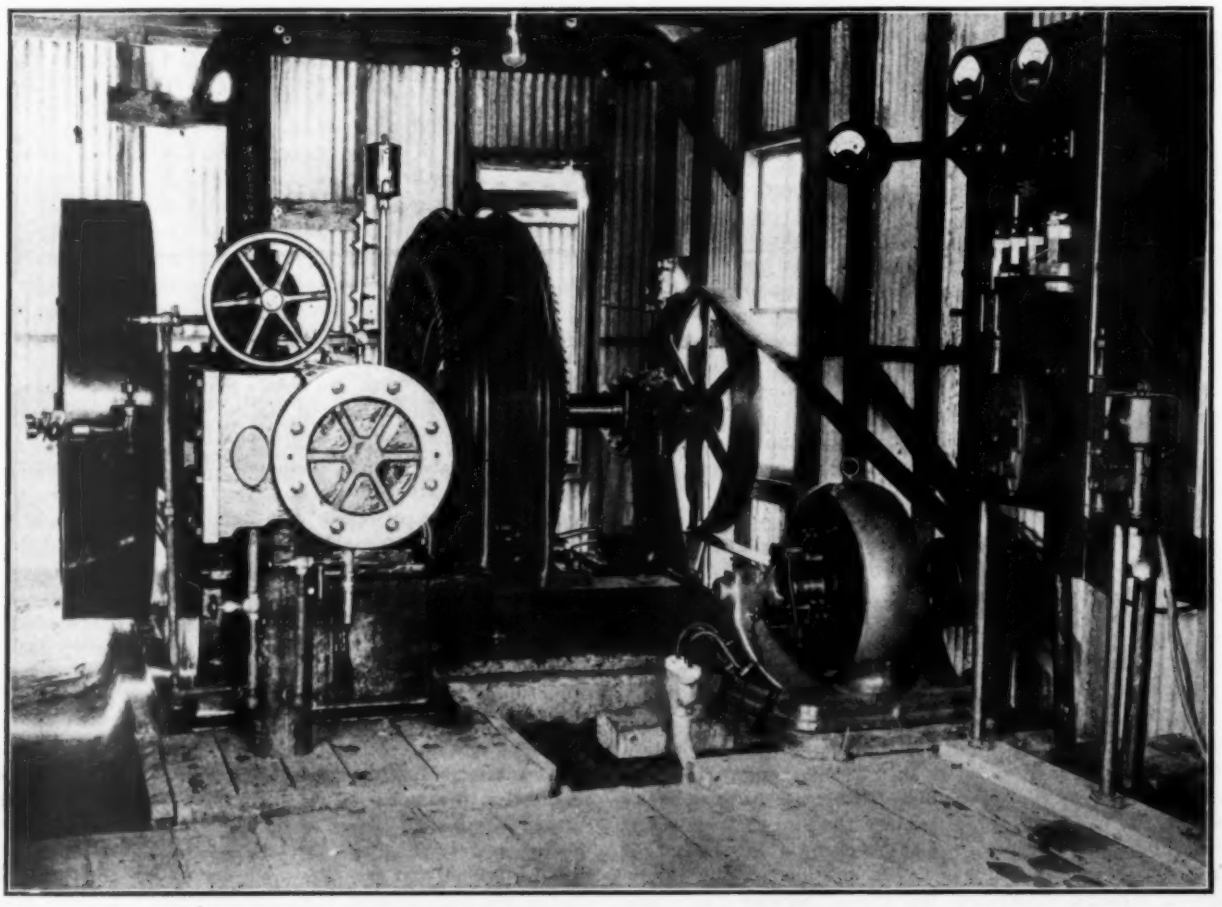
By W. G. Taylor

Industrial Power Series—Article No. 173.

THE gradual decline in production which is characteristic of all oil fields as well as the great losses sustained with the usual methods of steam operation are the factors which generally furnish an incentive to the producing company to electrify its wells. The economy thus gained often gives the wells a longer lease of life, as it enables them to be pumped at a profit at a lower daily production than would otherwise be possible. In most cases economy is only one of the several advantages of motor drive which are taken into consideration, these including greater reliability, simpler and more accurate speed control, steadier speed, greater safety and lower insurance rates than with other types of motive power. These advantages on any motor application are too well known to warrant more than incidental mention.

The choice between alternating and direct current is generally determined by the available power supply, and for this reason induction motors are used on nearly all electrically operated wells. Several isolated generating plants are in operation which were installed for the purpose of carrying an oil-well motor load and which were designed for alternating current because of the inherent superiority for this service of an induction motor over a direct-current machine. Although the latter may at first appear to be a more advantageous type of motor on account of the speed variation obtainable by field control without material reduction in efficiency, yet when it is taken into consideration that oil-well motors must often carry sudden and severe overloads, must be frequently reversed at full speed, and are subjected to much abusive handling by unskilled operators, the overload limitations of a direct-current motor prove to be a severe handicap. A more complex control is necessary to protect the motor, and if this is not provided the depreciation of the commutator is rapid on the heavy duty.

There is a large number of varied operations which oil-well motors are called upon to perform, and these fall naturally into three groups: drilling, pumping and cleaning. The process of drilling a well includes the operations of handling the drilling tools and the casing with which the hole is lined, and of removing the drillings by bailing or hydraulic flushing. The work of pumping includes such operations as are occasionally necessary to free the pump and valves from sand. The cleaning of a



100-Kilowatt Engine-Driven Generating Plant Supplying Power to a Lease of 15 Wells in Northern Louisiana. Pumping Is at a Depth of Approximately 1,000 Feet.

well is a process which varies with the conditions encountered. It is always necessary, however, to pull out the rods and tubing, which is known as "pulling" the well. The accumulated sand and sediment are then removed by bailing or hydraulic washing, and may first require loosening up with a light "string" of drilling tools. Swabbing is sometimes done to improve the flow of oil.

The most logical method of applying motors to these operations is to use a different machine for each of the three groups, as this not only involves the least complication in design, but also requires the minimum investment by the oil company, consistent with efficient operation. It has, however, been found more practical in most cases to use one motor for the drilling process and another for all the work involved in pumping, pulling and cleaning the wells.

Drilling.

The two methods of drilling which are in general use in the United States are the standard or cable-tool method and the hydraulic rotary method. The former employs a walking-beam from the end of which a heavy stem and bit are suspended by a steel wire or manila rope. These churn the hole by the up-and-down motion imparted by the beam, the strata thus being penetrated by percussion. The drillings are mixed with water in the hole and are removed at intervals by a "sand-pump" or bailer. As the hole deepens, iron or steel casing is inserted in

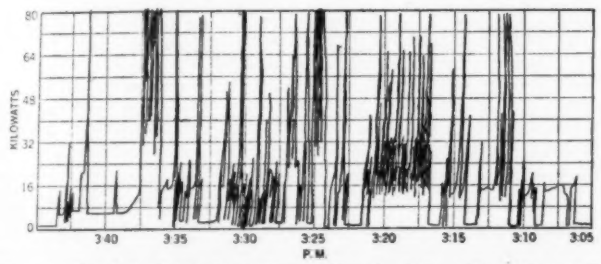


Fig. 1.—Graphic Record of Power Required for "Spudding In" Casing in a California Oil Well.

approximately 20-foot lengths, screwed together, but may not be used where there is no danger of caving.

In the arrangement of the standard motor-operated drilling rig used in the California fields, for actual drilling work the drilling line is suspended from the end of the walking-beam, but the hoisting of the tools is done by the bull-wheel, rope-driven from the band-wheel, with the walking-beam disconnected from the crank. The drilling line is wound on the bull-wheel shaft and passes over a sheave on the crown block. Casing is handled in a similar manner by the calf-wheel, with the addition of a block and tackle having from seven to nine lines. The bailer, which is a long tube with a check valve at the lower end, is hoisted by a separate line wound on the sand-reel, the latter being run from the band-wheel by friction drive. On rigs not having a sand-reel the bull-wheel is employed for this purpose.

The heaviest work encountered by the drilling motor is the manipulation of the casing. It is frequently necessary to repeatedly raise and lower a string of casing a few feet for long periods in order to relieve the friction caused by pressure of the surrounding strata, and thus work a clear passage. This is known as "spudding in" the casing. It requires continued reversing of the motor under heavy load, and is very well illustrated by the graphic record shown in Fig. 1, which was made on a 50-horsepower equipment. It is important that the motor should have ample margin in torque to accomplish this without overheating or stalling, as failure to free the string of casing compels the operator to continue with a smaller diameter. Occurrences of this kind would result in the minimum diameter being reached at too shallow a depth and thus render it impossible to continue drilling to the oil sand.

The other drilling operations are lighter work for the motor, as will be seen by a comparison of Figs. 1 and 2. The power demand from the motor to merely swing the tools during actual drilling by the cable-tool method is

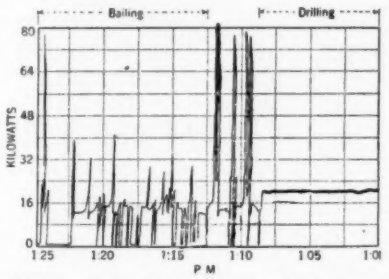


Fig. 2.—Graphic Record of Power Required for Drilling and Bailing Work in a California Oil Well.

fairly steady, as Fig. 2 shows, but it is interesting to note that this demand becomes less as the well grows deeper. Fig. 3, which represents this fact, shows a curve plotted from readings taken during the various stages of drilling a 3,100-foot well. The point may be explained by the fact that as the well grows deeper the drilling tools used are smaller in diameter and lighter in weight, and a larger amount of water is usually carried in the hole.

After a well has reached a depth of 300 or 400 feet, the amount of energy required per hundred feet for all drilling operations by the standard method increases with the depth of the well. Although it has already been pointed out that the power necessary to swing the tools grows less, on the other hand the length of time required for bailing increases in proportion to the depth, with little or no reduction in horsepower, and the dash-pot action in pulling out the bailer becomes greater, due to the larger amount of fluid carried in the well. It is also usually necessary to work the casing more frequently as the depth increases, in order to prevent it from "freezing" or sticking. Both of these conditions cause a considerable increase in energy consumption. Furthermore, progress becomes slower as the well deepens. Therefore, considering all of these points, it is apparent that the kilowatt-hour consumption will increase more rapidly than in direct proportion to the depth, and actual results plotted in Fig. 4 for a 2,060-foot well indicate that it varies approximately as the square of the depth, barring accidents and extensive jobs of "fishing" for lost rope,

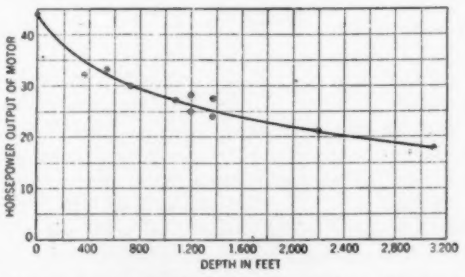


Fig. 3.—Horsepower Required for Swinging Standard Cable Tools in Drilling a 3,100-Foot Oil Well in West Virginia.

tools or damaged casing. The individual points also plotted in Fig. 4 represent the total power consumption recorded in drilling other wells of various depths. They check as closely as could be expected with the record for the 2,060-foot well at a corresponding depth. Under the usual conditions encountered, and without any great amount of bad luck in the drilling work, the average daily power consumption when the motor is in use, is

about 230 kilowatt-hours, but it will vary on different days from approximately 135 to 400 kilowatt-hours, depending upon what class of work is being done.

The most successful drilling motors now used in American oil fields are of the slip-ring induction type with secondary resistance control arranged for reversing duty. A capacity of 50 horsepower is usually sufficient for wells not exceeding 2,500 feet in depth, though cases have occurred where 75 horsepower was necessary on wells from 2,000 to 2,500 feet in depth, as well as on the deeper ones. The belted arrangement with a countershaft has proved the best, as the severe service has rapidly put out of commission the various types of gear drive which have been tried.

In the cable-tool method of drilling, the beam must overspeed and allow a relatively free drop of the tools on the down stroke to obtain the most effective blow; the motor to accomplish this must therefore slow down on the up stroke and speed up on the down stroke. This is quite successfully accomplished by so proportioning the pulleys that the motor will have some secondary resistance in circuit when running at the correct drilling speed. There is also required a very fine adjustment of speed

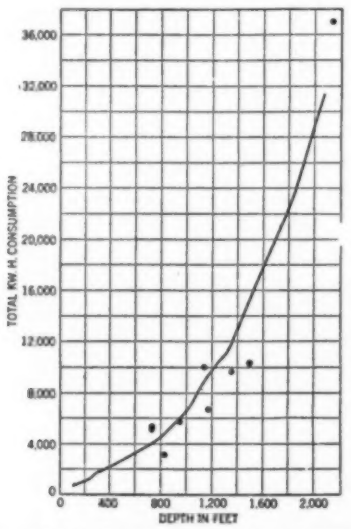


Fig. 4.—Curve of Total Power Consumption Covering All Operations in Drilling a 2,060-Foot Oil Well by the Standard Cable-Tool Method. The Individual Points Plotted Are the Total Recorded Kilowatt-Hours on Various Other Wells.

to make the movement of the beam accord with the natural period of vibration of the drilling line due to its elasticity. Failure to obtain the exact speed results in deadening the movement of the bit and may strain the line and rig dangerously. A suitably designed liquid rheostat would be an ideal method of control if it received the necessary attention and a good quality of water, but unfortunately neither of these can be given it under the usual conditions in the oil fields and so drum controllers have been adopted. The main controller gives a coarse variation of speed and reverses the motor, and the auxiliary controller provides a means of obtaining fine speed control between the points on the main controller for either direction of rotation. These controllers are each operated by wire ropes extending to the headache-post in the derrick, the arrangement in this respect being similar to the method of throttle control employed with engine-driven rigs.

Drilling by the rotary method is accomplished by boring rather than by churning the hole. The drilling bit is supported at the lower end of a column of pipe which is held and rotated by a turntable. The latter is driven through a series of chains and gears. A hoisting drum, which is clutched in when desired, is also provided for handling the drilling stem and casing. The drillings are washed out by a stream of thin mud circulated by the "slush-pump" down through the rotating column of pipe and up outside of it, thus causing the pipe to turn more easily and preventing caving by plastering the sides of the hole with mud. Only a few wells have so far been drilled by this method with motor drive, but excellent results were obtained with the same type of motor as is used for the cable-tool method. A fairly close speed adjustment is needed to operate the bit at the most effective cutting speed, inasmuch as the latter varies with the nature of the strata encountered.

Pumping, Pulling and Cleaning.

Pumping is accomplished by means of a deep-well pump of the plunger type which is lowered on the end of a string of tubing to a sufficient depth to insure ample submersion. The plunger is operated by jointed iron or wooden rods extending down within the tubing and attached to the end of the walking-beam or to a pumping-jack operated from a central power-head. The flow of oil through the tubing to the surface is governed by suitable check valves in the barrel and plunger of the pump.

The rods and tubing must be frequently removed to clean out the well or to replace broken or worn parts, and the bull-wheel is then employed except where the use of pumping-jacks makes a portable hoist necessary. Rods are pulled with a single line, but a block and tackle with two or three lines is necessary for the tubing. Both are removed in lengths approximately 60 feet long, which usually consist of three 20-foot sections screwed together. Bailing, light redrilling, washing or swabbing may be employed in the process of cleaning.

There is no apparent way to calculate the power necessary to pump a well which will give figures uniformly consistent with actual tests, because of the difficulty of determining the effect of varying well conditions. For instance, a large amount of sand in the oil will increase the power necessary to pump it, while on the other hand gas may be present which will help lift the oil. No numerical value can be placed on these conditions, so the motor capacity for this duty is determined largely by comparison with results obtained on other wells. Owing to the fact that the conditions are generally changeable, it is best to have some reserve motor capacity for pumping. The power input will vary from day to day and even from hour to hour, and may increase considerably in a short time when the well is sanding up. Such variations are not so common, however, where the troubles from sand are few.

The following summary of records from over 200 California oil wells pumped on the beam, gives an idea of the motor load for pumping alone:

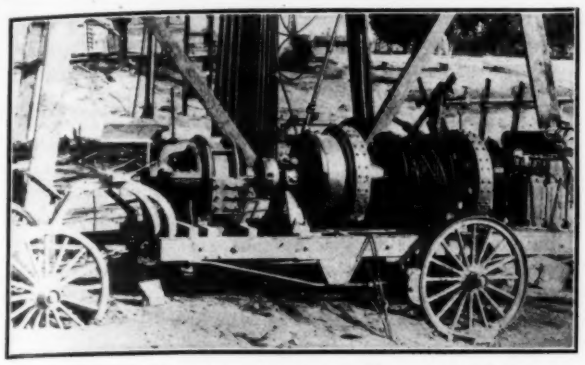
Depth of wells, 900 to 3,100 feet; average, 1,430 feet.
Length of stroke, 29 to 32 inches.
Strokes per minute, 20 to 30; average, 24.
Diameter of tubing, 3 inches.
Power required, 1 to 5 horsepower; average, 3.5 to 4 horsepower.

Exceptional wells in California have required as high as 16 to 17 horsepower at times. In Louisiana some heavy pumping wells have been encountered, one in the Evangeline field requiring the following:

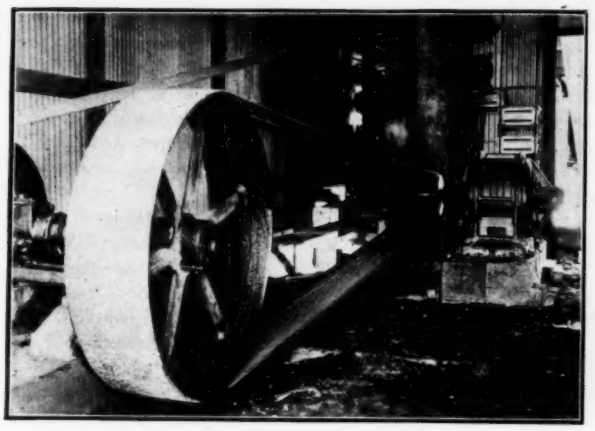
Depth of pumping, 1,100 feet.
Length of stroke, 30.5 inches.
Strokes per minute, 40.
Diameter of tubing, 2.5 inches.
Power required, 9.5 horsepower.

Another Louisiana well in the Caddo field gave test results as follows:

Depth of pumping, 1,000 feet.
Length of stroke, 37.5 inches.
Strokes per minute, 38.
Diameter of tubing, 3 inches.
Power required, 17.5 horsepower.

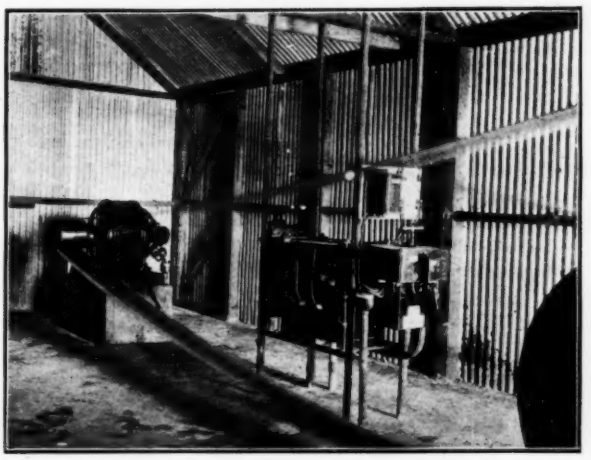


Portable Electric Hoist Used for Pulling and Bailing Oil Wells Pumped by Pumping Jacks in the Kern River Oil Field in California.

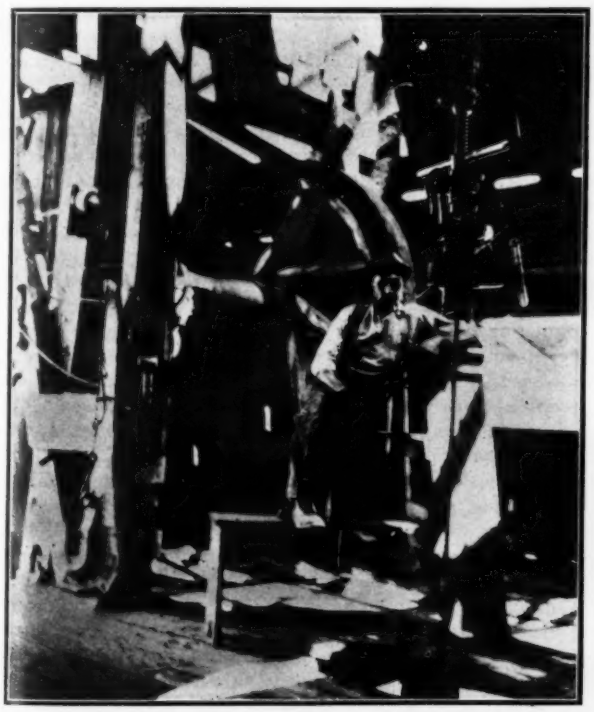


A 50-Horsepower Drilling Motor Operating Cable-Tools on a Standard California Rig.

Back-Geared Oil-Well Motor of the Y-Delta Type in the Kern River Oil Field.



Y-Delta Belted Motor With Concrete Foundation and Concrete Floor, Installed in California.



View of Actual Drilling Operations at the Well Shown in the Illustration at the Right, Using the Drilling Motor Shown in Upper Right-Hand Corner. Note the Rope Wheel on Headache Post for Manipulating the Controller and the Ammeter at the Left of the Headache Post, by Means of Which the Driller Observes the Amount of Effort Being Exerted by the Motor.

California Oil Well, Approximately 1,900 Feet in Depth, Entirely Drilled by Electric Power.

Compared with the California wells, these Louisiana wells have a longer stroke, higher speed, larger percentage of water and less gas in the oil, and therefore require more power. The Caddo well, compared with the one in the Evangeline field, has a little lower speed, but larger tubing and less gas in the oil, and therefore takes more power. The depth of well does not usually appear to be a factor from which any logical conclusions can be drawn.

It is interesting to note that the counterweight which is now quite widely used on the walking-beam to counterbalance the weight of the rods in the well was originally installed to reduce the motor load fluctation on each stroke, and was found to effect a saving in power as high as 22 per cent in some instances. Its use has since been extended in many cases to engine-driven rigs.

Where changes are frequently taking place in well conditions such as the rate of oil flow, the amount of sand with it, the amount of gas or water in the oil, the viscosity of the fluid or the condition of the pump itself, it is necessary to have a variable speed motor to permit the operator to pump at what he considers is the maximum economical rate, which may be limited by the rate of oil flow or the rapidity with which the rods and plunger will drop in the oil on the down stroke. On the other hand there are many cases where squirrel-cage motors meet all the requirements of pumping.

Pulling the rods and tubing is ordinary hoisting work, carried on at a maximum speed of the band-wheel which may be from 50 per cent to 100 per cent higher than the pumping speed. It demands an intermittent motor output of from 35 to 80 horsepower or even higher under some circumstances. A high torque machine is therefore most suitable. The greatest heating of the motor occurs when handling rods, because of the very frequent reversals which may occur from three to five times a minute for an hour and a half to two hours at a time. Low armature inertia is consequently very desirable. Pulling tubing requires the highest torque and determines the size of motor necessary. The rating usually given the motor for this duty is merely nominal, as the maximum torque obtainable is the determining feature. The maximum load is that encountered when lifting together the rods and pump and the tubing full of oil. In determining the motor capacity it is convenient to use the following formula for the horsepower required to lift tubing at a uniform rate of speed:

$$\text{Horsepower} = \frac{W \times d \times N}{63{,}000 \times L}$$

in which W = weight in pounds.
d = diameter of bull-wheel shaft in inches.
N = revolutions per minute of bull-wheel.
L = number of lines used in the tackle.

The constant 63,000 is based on a mechanical efficiency of the rig of 50 per cent. This is a fair assumption for the majority of cases, as will be seen by reference to Fig. 5, which is an approximate efficiency curve plotted from the results of several tests. In addition to the value obtained from this formula there must remain a sufficient margin in torque for acceleration. This depends largely upon the flywheel effect of the motor armature, as the revolving parts of the rig have relatively small inertia.

Of the various operations of cleaning a well, swabbing requires the heaviest demand of power. The work consists of lowering a plunger into the well casing and then pulling it out. The plunger has a tight fit in the casing so that the suction thus produced draws the sand out of the perforations at the bottom and thus clears the oil passages. The operation may be performed for several hours at the rate of two to four times per hour, each hoisting trip of the swab requiring several minutes Peak inputs to the motor from 40 to nearly 70 kilowatts have been recorded in this work.

The total monthly power consumption for all the work of pumping, pulling and cleaning a well will vary from approximately 1,350 to 6,000 kilowatt-hours, but the average is about 2,100 kilowatt-hours.

The necessity of employing a single motor for all of the work of pumping, pulling and cleaning is due chiefly to two reasons; first, the impracticability of using a portable hoisting equipment for wells that may have to be pulled every few days, particularly where the country is rough; second, the desire of a great majority of operators to have a machine which will take the place of the steam engine with little or no change in the method of operation.

The most successful and most widely used induction motors for this duty are of two types, the "Y-delta" and the two-speed. Except in special instances both are of the slip-ring type, the former being designed for changing the normal capacity by a change in stator connections made by a suitable switch, this not, however, affecting the speed; the latter has a pole-changing switch mounted on the frame by means of which both the speed and capacity are changed. Both machines require a controller and secondary resistance for speed variation, which with the two-speed motor are effective on either the high or

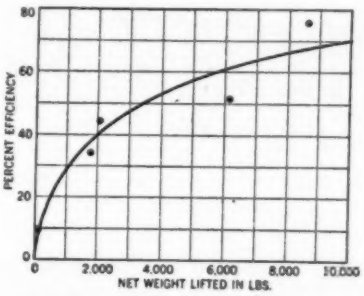


Fig. 5.—Approximate Mechanical Efficiency of Standard American Oil-Well Rig.

the low speed connection, as a six-phase rotor winding is used. A synchronous speed of 900 to 1,200 revolutions per minute is usually selected for either type of motor, and half-speed connection is used on the two-speed machine. Various ratings are employed, depending upon what the conditions require, among which are 20/7 horsepower, 20/10 horsepower, 25/8 horsepower and 30/15 horsepower. Smaller motors than these generally cannot develop the overload torque occasionally necessary in emergencies on nearly all wells. The low capacity is used for little else but pumping, and the design is therefore made for as high an efficiency as possible on this connection without sacrificing the required torque on the higher rating. The maximum momentary capacity is from 300 per cent to 450 per cent of the high rating, but full-load efficiencies of from 75 per cent to 85 per cent, the power factors nearly as good, are nevertheless obtained at full load on pumping duty.

With the Y-delta motor, a high speed for pulling can be obtained only by changing the pulley or by lagging up the bull-wheel shaft to a large diameter. Few operators care to be bothered with the pulleys, while there are some who will not consider the other method because of the increased strain on parts of the rig. Lagging the bull-wheel shaft furthermore does not speed up the sand-reel, so bailing must be done very slowly. But where the operator will use a lagged shaft and has no sand-reel, the Y-delta motor does very well, except for one point which in many cases is important. It is very often the practise to "shake-up" a well to free the pump valves from sand and thus avoid pulling the rods and tubing.

This is accomplished by increasing the speed of the walking-beam for a few minutes, but there is no practical way to do so with this type of motor, as the time required to change pulleys makes this method out of the question. The two-speed slip-ring motor, as may readily be seen, overcomes all these difficulties and has therefore received wide-spread approval by practical oil men.

The connections of the two-speed equipment are arranged to protect the double-rated motors by double-wound overload trip coils on the oil switch, which are so interlocked by connections with the switch on the motor that proper protection is automatically obtained. The controller is operated by a rope wheel from the derrick, as described for the drilling motor.

While the majority of installations use a belted motor with countershaft, there are many back-geared machines in operation. Oil men display a preference for the former, but most of the gear noise has been eliminated on the most recent back-geared installations by the use of cloth pinions.

The use of separate motors for pumping and pulling work requires little comment, as it is a simple proposition to select machines with the proper characteristics. The hoist motor must be portable, and either it may be coupled to a hoist mounted on a truck, or the motor equipment may alone be portable and designed to be belted to the countershaft at each well. Both methods are successfully used. The complete portable hoist is better adapted for wells pumped by pumping-jacks.

Pumping-jacks are operated together from a central point, the reciprocating motion being obtained by eccentrics or cranks which are belt driven. Motors have been applied to a large number, but no features of unusual interest are involved, as the duty is non-reversing and a friction-clutch is frequently used for starting the load. It is an interesting comparison with the individually driven well to note that the power required for jack-rig pumping averages approximately 2.5 horsepower per well and the average consumption is from 30 to 45 kilowatt-hours per day. The use of jacks has more than cut the power bill in two in some cases, but they are considered advisable only when the well production falls very low, as their use causes a loss of from 15 per cent to 25 per cent in production because of the impossibility of running each well at its most advantageous speed.

Oil-well motors have been used in eastern United States fields for the past 12 years, but active interest was not taken in them in California and the Middle West until 1910. The conditions encountered in those fields required the development of the equipments described in this paper, which with little or no change can successfully meet any conditions so far encountered in this country. During the first three years over a thousand wells were electrified in California alone. Although very little development work has taken place in the fields during the past two years, due to the very low market price of oil, it is estimated that there are between 1,500 and 2,000 electrically operated oil wells in the United States at the present time.

General Electric Company Gives Employees $550,000 Bonus.

Employees of the General Electric Company received during the week 5 per cent of their annual salaries as a bonus. The "supplementary compensation," as it was called, had been voted by the directors as a result of the most successful year in the company's history.

The extra payments were made to all employees of the company throughout the United States who have been with the concern five years or more. About $550,000 was distributed among 19,900 employees.

Cost of Installing Four Large Electric Mine Pumps.

The installation of equipment to handle 9,500 gallons of water per minute, 8,000 gallons of it by centrifugal pumps, furnishes costs of much value. The equipment may be briefly described as follows:

Capacity of the Pumps and Motors Installed.

Two 3,000-gallon-per-minute, 10-inch, six-stage, solid bronze centrifugal pumps with a 325-horsepower, 700-revolutions-per-minute, three-phase, 25-cycle, 440-volt motor for each pump.

One 2,000-gallon-per-minute, 8-inch, six-stage solid bronze centrifugal pump with a 225-horsepower, 700-revolutions-per-minute, three-phase, 25-cycle, 440-volt motor.

One 1,500-gallon-per-minute, 16-inch stroke, 13-inch plunger triplex pump with 150-horsepower, 500-revolutions-per-minute, three-phase, 25-cycle, 440-volt motor.

Total rating of motors, 1,025 horsepower.

ACTUAL COST OF PUMPS, INSTALLATION AND FOUNDATIONS.

	Cost	Per Cent.
Pumps, motors, electrical material, etc.	$26,186.49	68.41
Unloading and transporting pumps	227.35	0.59
Labor and material expended in foundations, floors and walls	2,373.67	6.20
Installing pumps	1,777.20	4.64
Electrical work	1,359.17	3.55
Compressor pump complete and its erection	320.00	0.84
One 18-inch column and one 20-inch, each 268 feet long	5,007.32	13.08
Placing column and batteries in shaft	315.84	0.83
Lumber for batteries to hold pipe and for shaft studding	281.89	0.74
Hoisting engineers (handling material and column)	427.24	1.12
Total cost of installation	$38,276.26	100.00

The bottom of a shaft that had been recently abandoned was utilized for a pump room, the columns being run up one compartment, and a stairway with landings every 20 feet being placed in the other compartment. As the amount of steel timber used and the cost of the rock work and sump would vary with different strata, this cost has not been included in the tabulation.

Under normal conditions the 1,500-gallon triplex pump is used to keep down the level of the water in the sump. The total capacity of 9,500 gallons was provided for periods of high water. It is about twice the inflow at such times and so allows a large factor of safety for emergencies or accidents of any kind.

Owing to the acidity of the water to be handled, no commercial foot or gate valves were used, but a priming apparatus with special wood-lined check valves was provided. Long-radius fittings and increasers were used on the piping immediately after leaving the pump, to decrease the friction of the water.

The water lift from the floor of the pump room to the point of discharge is 268 feet. The pumps supplant two large steam units and were installed during the latter part of 1914 and the beginning of 1915.—*Coal Age.*

Speedy Solution of Industrial Power Problem.

A brick yard at North Adams, Mass., had difficulty a few weeks ago in securing a licensed steam engineer to run its engine. The concern appealed to the local central station for help in its dilemma. A 75-horsepower motor was required to operate the plant, but a new motor could not be promised by the manufacturers inside a number of weeks. Consequently, the lighting company loaned the brick concern a 200-horsepower motor it happened to have on hand, and installed service at the yard with a delay of only one week.

When the new motor arrives it will be substituted for the motor temporarily in service.

Transmission and Distribution Problems

An Abstract of a Report Presented Before the Recent Convention of the Ohio Electric Light Association Giving Cost Data on Standard Construction

TRANSMISSION and distribution of electrical energy is today the problem of the hour, in the minds of central-station men. The following extracts from the report of the Committee on Transmission and Distribution of the Ohio Electric Light Association contain many points of interest.

Heretofore central stations were content to generate at one end and transmit to a center of activity without any consideration of the possible business enroute. At the present time it is difficult to locate a transmission line that is not supplying some attractive load enroute. To do this an entirely new problem must be solved. There are two things to be considered; first, present, and second, the future remunerative possibilities. Consumers of electricity must be developed, as well as the science of its generation and distribution. To use electricity is the first step in educating a consumer.

To serve a consumer or a group of consumers from a transmission line, there is required a switching and transformnig station, more commonly known as a substation. Herein lies the greatest expenditure necessary in supplying this class of business. Substations, indoor or outdoor, may be of large or small capacity. The outdoor substation has been made possible by the manufacture of electrical apparatus for outdoor installations. The outdoor substation has been used on the higher voltage system more generally because of the greater floor space necessary, due to the greater separation of the conductors. The larger substations produce a revenue warranting a greater expenditure and, therefore, a greater degree of protection can be installed. The larger installations have an attendant who could easily and properly take care of electrolytic arresters.

The smaller-capacity outdoor substation presents a more difficult proposition in that the immediate return upon the investment is such as to limit the expenditure to a minimum. The first and most noticeable feature of this class of substation is the lack of an attendant, for this reason placing the consumer entirely at the mercy of the quality of the service, without the most satisfactory method of protecting and assuring continuity of service. Quite often, normally, the central station is represented by someone, otherwise engaged, of the immediate community, who is electrically inclined. This representative is merely to be on hand to take care of the minor complaints and to notify the central station of any trouble that might arise. Granting that there will be some added delay in times of trouble, yet the smaller communities at the present time are more lenient in their demands, in that the slight inconvenience experienced does not irritate them into deriding electric service. Further to serve some of the smaller communities or an occasional consumer it is necessary from an advertising standpoint to promote the feeling that power is available and to educate the consumer to its uses. So it can readily be seen that the initial expense of the outdoor substation must be a minimum. There are certain essentials to all substations, namely, switch, choke coil, lightning arrester, and fuse considered below.

Switch.—The air-break switches used most frequently operate in the following manner. All three phases are tied mechanically so that they are all opened at the same time by means of an operating handle. The design of the switch is such that a knife contact is made for current carrying and a horn contact for making and breaking the connection. The horns are so designed as to aid the blowing out of the arc started in opening the switch. These switches are designed for pole mounting and operate either horizontally or vertically, the vertical contact having the most desirable characteristic of lifting the arc on the horns while opening. All air-break switches are designed in such a manner that the contacts are protected from the weather, that is, from the normal snow or rains, but when a dashing rain followed by freezing condition comes, the switch blades are often held fast. The open air-break switches are generally operated manually, but recently there has been developed a combination magnetically and mechanically operating device.

The switch is most essential in killing the live parts about a substation, making it possible to so isolate the substation from the remainder of the line, thereby permitting the remaining portion of the line to operate unaffected. The switches permit sectionalizing of lines and in this manner assist in locating trouble. The switch must be positive in its action, unaffected by inclement weather. The switch is vital to the substation. It should be so designed as to readily permit the replacement of an insulator without pulling down the whole switch. This can be done by mounting each insulator upon its removable pin and even then it is quite an item of delay.

Choke Coil.—The function of this is to separate and choke back the high-frequency current, thereby permitting relief to be had by means of a ground connection through some form of a lightning arrester. The choke coils vary in design mechanically, although their duty is the same, as is their action. The choke coil is very essential in forcing surges or high frequency over a path designed for its relief.

Fuse.—Protection in high-tension work is very essential to the transformer life. The apparatus protected on high-tension systems is so costly that the cost of replacing a fuse cannot be considered as compared to the likelihood of replacing a transformer and thereby causing a greater outage than that necessary to replace a transformer fuse. The high-tension fuses are of the horn-gap type, where the gap is bridged with a piece of aluminum or German silver fuse wire, or the inclosed fuse, that is, the fuse inclosed in a glass tube filled with a fire-extinguishing liquid. This type of fuse is mounted in clips and must be mounted in a slanting position, almost vertical.

Of the two kinds of fuses, the wire fuse is the cheaper and more easily replaced, more durable, requires a less investment than the chemical fuse. The chemical fuse, although refillable, is not as easy to replace in that it must be returned to the manufacturer and in this way causes a considerable outlay of money to have ample supply for replenishing the various sizes of fuse in use.

FUSE WIRE.

B. & S. Gauge.	Actual Melting Current in Amperes.	Approximate Feet per Pound.
10	220	104
11	195	135
12	160	165
13	140	208
14	115	264
15	100	332
16	80	420
17	65	528
18	55	688
19	45	835
20	35	1050
21	30	1350
22	25	1680
23	18	2150
24	12	2670
	German Silver	
26	7.5	1300
28	6	.....
30	2.25	3288
36	1	13217

The wire fuse requires a pair of horns for the blow out of the arc started by the blowing of the fuse. One of the undesirable features experienced with the smaller fuse wire is the ease by which the fuse can be damaged mechanically and consequent outage due apparently to no cause. This in itself is very undesirable in that the continuity of service is not what it should be nor what is demanded. A method of increasing the mechanical strength of the very fine fuse wire might be placing the fuse wire in a piece of gauge glass with a heavier piece of wire from the tube to the stud or set screw on the horns. This would free the fine wire of the exposure and also absorb a portion of the shock in blowing of the fuse by the quenching effect of the glass tube shattered.

Lightning Arresters.—The subject of lightning protection presents quite a problem when individual protection is sought. There are many types of lightning arresters in operation at the present time and as yet none have proven as absolute as has the electrolytic cell, used where the substation is of such size and importance as to demand an attendant. The real problem is that demanding protection for the smaller substation, for quite often an outdoor substation will be necessary for a consumer or consumers, where the immediate returns upon the investment are small and therefore the expense of the construction must also be small, and yet it must have protection. The protection available at the present time is not adequate for this class of service. When the substation is unattended, automatic relief must be had and this in such a manner as not to cut the transformer from the line in order that the service might be kept working. The general performance of the present arrester is the spill over and the blowing of the fuse at the same time. The present arrester in general use is through choke coil with a horn gap provided with a grounded connection through resistance. The resistance used in this ground connection is not as yet designed satisfactorily, nor is the material from which it is made truly satisfactory in that it is not stable. The results to date point to the fact that fuse protection seems to be the sole protection and this can be had at much less expense than installing the present form of lightning arrester. Greater care should be exercised in routing the line through sections that attract lightning, when it is possible to choose, and not depend wholly upon lightning arresters for relief and protection.

Future Development.—The central stations are responsible for the developments of the outlying business. The natural growth of this business is slow until the confidence of the community is received and then the business increases with greater strides. Unfortunately, the business is scattered, which requires several outdoor substations for immediate service. As this business increases there will be found several distributing branches that from time to time grow towards one another and finally can be made one and the same system served from one or two outdoor substations. From this it can readily be seen that the expenditure for the outdoor substation must necessarily be limited.

Cost Data.

With every outdoor substation there seems to arise an entirely different problem demanding solution. To do this economically, it is difficult to adopt any standard for a substation. The following installations found on transmission systems in Ohio represent general practice.

Verona, O.

One 50-kilowatt, single-phase transformer, 33,000/2,200 volts.
One 40-kilowatt, single-phase transformer, 2,200/110-220 volts.
One 1-kilowatt pole-type serves street-lighting regulator.

This is a wood structure made up of two class A Michigan cedar 50-foot poles, with heavy oak platform construction and provided with 35,000-volt air-break switches, double choke coils in series, and horn-gap lightning arrester.

Cost, transformers not included.

Switching apparatus and lightning protection	$130.00
Poles, crossarms, insulators and miscellaneous material	69.80
Labor and transportation	74.60
	$274.40

Shoup's Station, O.

Five-kilowatt, single-phase transformer, 33,000/2,200 volts, serving consumers with a distribution system approximately three-quarter of a mile. Consists of two disconnecting switches, two horn-gap fuses, the fuses being the only protection to the transformer, with exception of the ground wire strung across the peak of the tower. This substation is constructed on one of the transmission line towers, and therefore requires no additional right of way or structure.

Transformers not included in cost.

Switching apparatus	$ 75.00
Miscellaneous material	72.91
Labor and transportation	152.34
Total	$300.25

Alpha, O.

Three 10-kilowatt, single-phase transformers, connected delta, 33,000/230 volts, serving one power consumer, with a short secondary extension to building. This is a wood-pole structure made up of four class A Idaho cedar poles provided with air-break switch, choke coil, fuse and lightning protection. A special right of way for structure was necessary. The wood structure is not as satisfactory as steel, for the variation in the timber is too great to warrant a plumb structure.

Cost, transformers not included.

Switching apparatus and lightning protection	$260.00
Miscellaneous materials	167.02
Labor and transportation	242.06
Total	$669.08

Trebein, O.

Three 15-kilowatt, single-phase transformers, connected delta, 33,000/2,200 volts, serving two power jobs and a small community, with a distribution system of three-quarter mile. This is a steel structure, the weight of the transformers being wholly supported by latticed column supports and the tower is required to do just a slight amount of additional duty. No special right of way was necessary. This station has the same switching facilities and lightning protection as at Shoup's Station.

Cost, transformers not included.

Switching apparatus and lightning protection	$260.00
Miscellaneous materials	93.32
Labor and transportation	209.14
Total	$562.46

Osborn, O.

Three 25-kilowatt, single-phase transformers, connected delta, 33,000/2,200 volts, serving the town of Osborn with a distribution system.

This is a steel substation located upon a large site; contains two complete sets of switches, choke coils, fuses and lightning arresters; one set for sectionalizing and protecting a line to a neighboring village, and the other for protecting the transformers installed at this point.

Cost, transformers not included.

Switching apparatus and lightning protection	$520.00
Miscellaneous material	264.12
Labor and transportation	191.35
Total	$975.47

Urban Distribution Problems.

In order to obtain general continuity of service and a reasonably steady pressure at the consumer's premises, it is the com-

mon practice of central stations to split urban distribution systems into sections, each of which is supplied by a separate feeder. Provision is usually made for a quick means of sectionalizing each feeder in order to locate trouble, such as a burnt out transformer or lightning arrester, and, in case several feeders are in the same vicinity, emergency ties are used to transfer the load of any feeder to the adjacent feeders. Load transferring is particularly necessary where lead-covered cable forms a portion of a feeder, owing to the time required to locate and repair cable faults.

Feeder Systems.—The selection of the proper method of arranging feeder copper to supply a given territory depends upon the character and density of the load.

In small commercial districts or in built-up residence territory, especially with groups of apartment houses, the density may be very great and it is not unusual to obtain a diversified load of 50 kilowatts in one city block. Where a load is thus concentrated in block form a feeder to the load center and a few primary laterals are all that is required to group several blocks.

For commercial load a typical development is along the line of the main artery of traffic, resulting in a very long and narrow feeder territory with the load uniformly distributed. To handle this on a feeder so that there is a reasonable uniformity of pressure everywhere usually requires a feeder to the load center, which in turn supplies primary mains running each way from the load center. This gives a two-way feed and each branch carries one-half of the load for one-half of the distance, or a gain of 4 to 1 in pressure loss over a set of feeder wires with the transformers connected directly on the feeder.

If the character of the service is such that only a very small pressure drop is permissible, the idea may be still further extended by using a system consisting of a feeder, subfeeders and mains. The feeder is carried to the load center and there connected to a second set of wires called the subfeeder, which feed from the load center in both directions, and the ends of the subfeeder are connected to a third set of wires called the mains, to which all transformers are connected. This results in dividing the load into four parts, each part carries one-fourth of the distance, or a gain of 16 to 1 in pressure loss over a single set of feeder wires with the transformers connected directly to the feeder.

A third typical case of feeder territory is encountered in suburban districts partly developed in scattered allotments. To handle this condition on one feeder the usual practice is to carry a feeder to the load center and from there radiate with two, three or four subfeeders, each of the latter being carried to the center of its particular group of load.

Careful selection of the proper system makes it possible to group as extended a territory on one feeder as is necessary to give the desired total feeder load, irrespective of the load density of the territory served, and still maintain nearly uniform pressure on the mains to which the transformers are connected. This is quite important, since it results in uniformity, standardization and economy of the station feeder equipment.

Station Feeder Equipment.—Station feeder equipment will vary somewhat in different localities. For stations radiating a small number of feeders on which there is a fairly steady load it may be possible to obtain fair pressure regulation with a single bus regulator. The bus regulator cares for variations in the supply pressure to the station and can be arranged to compensate for the average feeder losses as the load comes on. This arrangement is open to the obvious disadvantage that if any one or more feeders are exceptionally long, or are loaded when the other feeeders are idle, the pressure on the former will be low. A much higher standard of service is obtained if regulators are installed on each individual feeder. When this is done it is customary to employ line-drop compensators, which give an indication in the station at all times of the pressure at the load center. The proper pressure may be then maintained on each feeder, moving the regulator either by hand or automatically. If the proper feeder system is employed and automatic regulation is used at the station, the pressure at any point on the mains should not vary appreciably from normal, resulting in a very high standard of service.

It is customary in urban distribution to group from 75 to 150 amperes on a feeder. This amount of current is economically correct for several reasons:

(1) The minimum amount of station floor space and feeder equipment will be required if the load per feeder is large and the number of feeders is small.

(2) For 60-cycle distribution systems the electrical characteristics of large conductors are such that for moderately long feeders it is not economical to use a larger size of wire than No. 0. If 4/0 wire is used, the copper investment is double that of No. 0, and the amount of current which can be carried with the same pressure loss is only increased about 60 per cent. This is due to the skin effect of alternating current in large conductors increasing the effective resistance, and also to the fact that the reactance of a large wire is but slightly different from the reactance of smaller wires.

(3) For standard cross-arm construction the factor of safety is too low to permit of larger copper than No. 4/0. Even No. 4/0 extra heavy angle braces should be employed on the long cross-arms, since the usual type of strap brace has no strength in compression and the cross-arm takes the entire strain of the wires.

We see, therefore, that while station economy dictates the use of heavily loaded feeders, the electrical and mechanical limitations of the distribution lines limit the current to approximately 150 amperes per feeder.

Discussion.

In discussing this report, G. N. Lemmon, of the Railway and Industrial Engineering Company, pointed out that not only switches with knife contacts were available for outdoor use, but also contacts of flexible copper brushes against a flat surface. He approved the use of gauge glasses around small fuse wires, arranged with contacts as for cartridge fuses. When insulators supporting switches are broken, he advised replacing the insulator on the pin in the case of large switches, but for small ones it is better to replace the entire switch, making repairs in the shop.

H. W. Young, of the Delta-Star Electric Company, divided substations into three classes; the small installation supplying one or more consumers; the medium-capacity type supplying a group of consumers or small communities; and the high-capacity type which may serve a single large consumer, may serve a town or furnish power to a comparatively large territory.

The first type or small station is the most difficult to handle, as the cost per kilowatt is high when compared to the larger stations. The income is often small and the result is a rather low earning capacity. It should be borne in mind, however, that the service given by a small-capacity outdoor substation is one which as a rule could not be undertaken with any other form of equipment. In spite of the fact that the low-capacity station is high in cost per kilowatt as compared to a high-capacity station—it is a very necessary equipment in developing power loads along transmission lines.

In common with all lines of business, the cost per unit rapidly decreases with increased output, so that as substations increase in capacity the cost per kilowatt rapidly decreases. For example, a 25-kilowatt, single-phase, 22,000-volt, 25-cycle substation with wooden poles and platform construction costs approximately $22 per kilowatt or $550. This cost includes the following items: transformer cost, $13 per kilowatt; switching and protective equipment, $5 per kilowatt; structural material and labor, $4 per kilowatt.

A 900-kilowatt, three-phase, 22,000-volt, 25-cycle steel-

tower substation costs $4,398.18, this being a cost of $4.88 per kilowatt, divided as follows: material cost, including transformers, $4.33 per kilowatt; labor cost, 55 cents per kilowatt. The labor cost on this particular station included hauling the transformers a considerable distance over poor roads, and this constituted practically half the total labor cost.

Taking a line of commercial stations from 50 kilowatt to 3,200 kilowatt at 13,200, 22,000 and 33,000 volts, three-phase, it is interesting to note the cost per kilowatt of the complete high-tension switching, fusing, choke-coil and lightning-arrester equipment. Especial attention is called to the rapid decrease in cost with increase of transformer capacity.

Net Costs Per Kilowatt of Equipment. 100 Per Cent Overfusing of High-Tension Side; 13,200 Volts, Three-Phase.

Kilowatts	A	B	C	D	E
50	$5.00	$6.00	$6.90	2.2 cents	$3.50
100	2.32	3.07	3.52	1.38 cents	1.75
250	1.00	1.26	1.45	0.8 cents	0.89
500	0.50	0.66	0.75	0.53 cents	0.35
1000	0.28	0.35	0.40	0.37 cents	0.18
2000	0.15	0.19	0.21	0.22 cents	0.12

22,000 Volts.

Kilowatts	A	B	C	D	E
50	$5.50	$7.30	$8.20	2.2 cents	$3.50
100	2.75	3.65	4.10	1.1 cents	1.75
200	1.40	1.86	2.05	0.69 cents	0.88
400	0.72	0.95	1.06	0.5 cents	0.44
800	0.40	0.52	0.57	0.33 cents	0.22
1600	0.23	0.27	0.30	0.24 cents	0.11
3200	0.14	0.15	0.16	0.14 cents	0.09

33,000 Volts.

Kilowatts	A	B	C	D	E
50	$6.00	$8.00	$9.80	2.2 cents	$3.50
100	3.25	4.25	4.90	1.1 cents	1.75
200	1.70	2.16	2.50	1.43 cents	0.88
500	0.74	0.94	1.07	1.35 cents	0.35
1000	0.40	0.50	0.57	0.39 cents	0.22
2000	0.21	0.27	0.30	0.3 cents	0.11

Column A covers the cost of double-break-per-phase three-pole switches and simple horn-gap arresters.

Column B is the same as A except that the arresters have limiting resistance in the ground circuit.

Column C is the same as A except that arresters are of the high-speed sphere-gap high-capacity resistance type.

Column D gives cost per kilowatt per phase of chemical fuse renewals.

Column E gives cost per kilowatt of hot-galvanized steel tower frames.

The above cost data cover modern high-grade equipment and clearly demonstrate that outdoor substations in their standard commercial form can be profitably used.

Primarily the object in distributing high-tension power is to make a profit for the central station and it is daily being demonstrated that the modern outdoor substation is a vital factor in securing this profit.

W. F. Sneed, of the General Electric Company, said that automatic outdoor swiches are not reliable. He favored the expulsion type of fuse, and pointed out the dangers of the horn-gap arrester, which he considered the weakest element in the outdoor substation.

F. C. Caldwell, of Ohio State University, pointed out that under usual conditions the outdoor substation must be designed for the lowest possible cost. The lower the cost, the more electric service can be extended. He pointed out that the greatest economy in wire size in a branching system is obtained by making the cross-section of wire proportional to the square root of the current. Thus, if 100 amperes are carried up to one point and 36 amperes beyond that, the wire sizes should be in the ratio of 10 to 6.

D. L. Gaskill, of Greenville, O., told of his experience with transmission lines and outdoor stations. He favored using the latter whenever possible, and advocated stranded wire in all sizes larger than No. 4, since defects in solid wire cannot be detected on inspection, but cause breaks after installation. The extra cost of stranded wire is offset by the ease of construction. He favored also an overhead grounded iron wire.

Karl A. Katzenberger, of Lewisburg, O., and A. A. Pointer, of Fort Wayne, Ind., said that grounded overhead wires seemed to give complete protection. On 10 miles of line not so protected three transformers were lost.

F. W. Funk, of Youngstown, O., considered that costs per kilowatt had no significance since they depend so largely upon the details of the particular substation and type of equipment, and moreover the prices of material have changed markedly of late. He said that lightning arresters should be so mounted as to protect the line when the switch is open.

Electric Vehicles at Hartford.

The use of electric trucks at Hartford, Conn., has shown a continuous and substantial growth since the Hartford Electric Light Company inaugurated battery charging service on a mileage basis of price. There are now seventy-six commercial vehicles taking this service, including the central station's own wagons. An entirely separate department from the company's other business handles the electrical vehicle business.

New White Way System in Operation in Ennis.

The city of Ennis, Tex., now has in operation a beautiful, modern "White Way" lighting system consisting of 37 ornamental metal standards placed in prominent positions in the down-town district.

Lighting Standard Installed at Ennis.

The electric light company has removed all its poles from the main streets and the new installation of "White Way" units present an attractive appearance.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

CENTRAL-STATION ACTIVITIES IN PHILADELPHIA.

Summer House-Wiring Campaign Being Conducted With Marked Success.

The Philadelphia Electric Company, which occupies an entire seven-story building at Tenth and Chestnut Streets, is about to erect a new structure adjoining, which will duplicate the present building. The whole ground floor and basement will be devoted to the sales and appliance department.

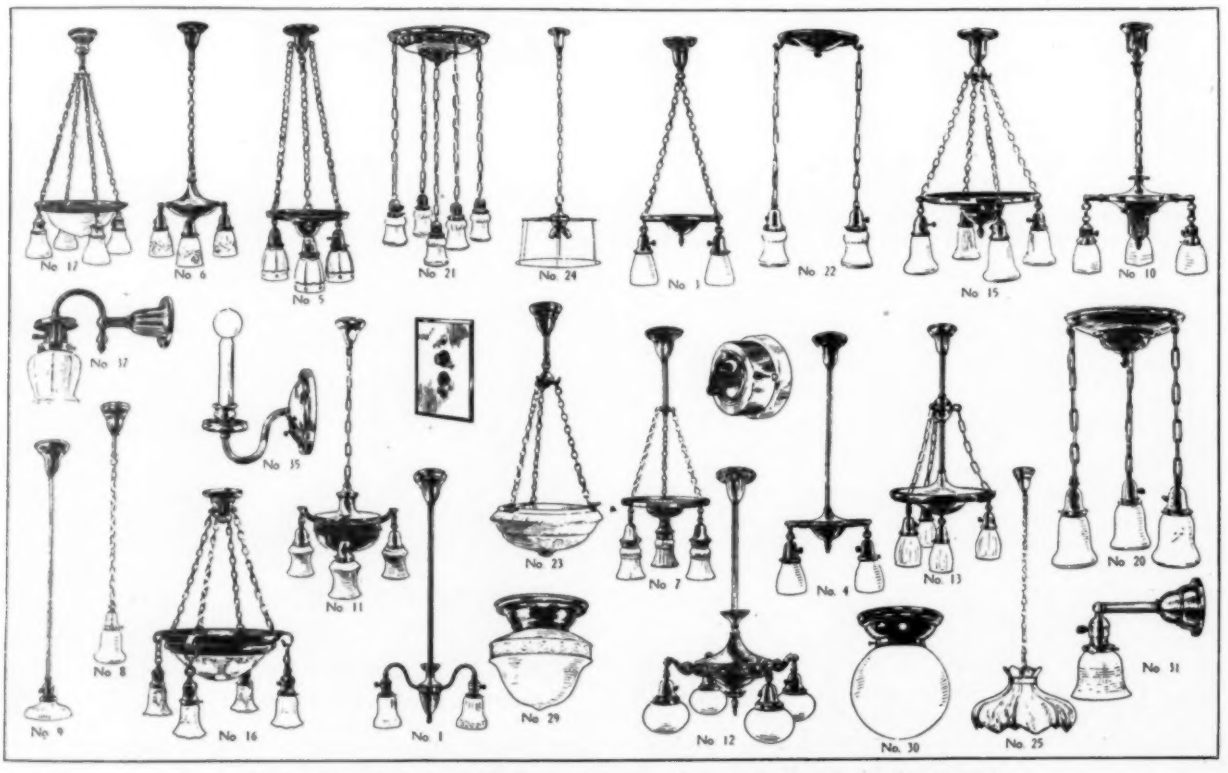
The company now occupies, in addition to its main building, an annex at Tenth and Sansom Streets, where the lamp department is located on the first floor, the underground and inspection departments on the second floor and the purchasing and claims departments on the third floor. These will, in part, be transferred to the enlarged main building, where will be continued the executive offices.

The Philadelphia company is at present conducting a systematic campaign for the wiring of existing residences that is worthy of special note respecting certain of its features. The campaign was begun May 1, following a reduction in residence lighting rates from 10 cents per kilowatt-hour, flat, to a new rate under which the first 12 kilowatt-hours are charged for at the rate of 9 cents, the next 75 at 7 cents, and all in excess of the 87 kilowatt-hours at 5 cents.

The company found from actual figures that $1.08,—the first 12 kilowatt-hours at the 9-cent primary rate,—is about the average monthly lighting bill of the average customer for residence service. This means, in effect, that electric domestic appliances will be used at the 7-cent and 5-cent rates, and that a moderate use of current for the operation of such devices will result in a monthly cost to the consumer very slightly in excess of his bill, with no such service, under the former 10-cent rate.

About 100 leading electrical contractors in the company's territory, which includes Chester, Pa., as well as Greater Philadelphia, bonded themselves together in an association known as the "Wire-Your-Home League." They made up a schedule of prices on the wiring of already built houses, putting the schedule on a basis of price per outlet, so that any householder can figure with readiness the exact cost of wiring his house. The prices were made as low as is consistent with good, honest work.

The fixture manufacturers co-operated to make the wiring offer attractive. The fixtures offered are not special in the sense that they have been hurriedly assembled in large quantities for quick sale; they are substantially built and are guaranteed to give satisfaction for a lifetime. The designs of the fixtures and glassware were attractively advertised in a folder issued by the company. The pamphlet was printed on pale green-coated book paper, with the glassware of the fixtures printed in white and the fixtures themselves in glossy black. Each design of fixture bears a number corresponding with that in a price list, in which 37



Fixtures Used by Philadelphia Electric Company in Its House-Wiring Campaign.

different designs were given, ranging in price from $2.50 to $41.50. The detailed prices are as shown in the accompanying table.

TABLE OF FIXTURE COSTS.

Design No.	Price	Design No.	Price
1	$ 6.50	20	$11.00
2	6.20	21	16.10
3	6.85	22	9.40
4	6.85	23	13.50
5	12.50	24	18.20
6	12.20	25	11.50
7	13.50	26	9.80
8	3.85	27	10.50
9	3.50	28	3.50
10	16.50	29	2.50
11	15.75	30	2.90
12	20.25	31	2.85
13	15.20	32	3.25
14	14.50	33	3.40
15	15.50	34	3.50
16	41.50	35	6.20
17	27.50	36	5.85
18	15.10	37	5.50
19	17.50		

The complete set of 37 fixtures is exhibited at each of the company's nine district offices. The prices are controlled entirely by the amount of stock on hand, and as soon as this is exhausted and the manufacturers are forced to go into the open market to replenish it, prices may have to be advanced.

A corps of salesmen were set at work in each of the districts, working from the district offices. Contractors are also actively co-operating, in urging the making of contracts, which, however, are entirely between the customer and the Philadelphia Electric Company. The company pays the contractor's bill on completion of the job and its inspection and acceptance, and collects from the house owner in either 12 or 24 equal monthly installments, with no interest charge for deferred payments. The company also pays for the fixtures and collects from the customer in two to six months, according to conditions, no interest being required. The offer applies, of course, only where satisfactory credit is established.

In case the customer has any preference as to which contractor shall do his work, the one designated does it; otherwise the work in each district is evenly apportioned among the contracting houses in that district.

Wiring Prices.

The following are the unit prices for wiring:

Ceiling outlet for chandelier without switch control	$2.00
Outlet for bracket light without switch control	2.24
For snap switch, add	2.74
For single control push button switch, add	3.24
For double control push button switch, add	7.08
For water-proof porcelain receptacle for bathroom, cellar, etc., add	.50
For drop cord attachment, add	1.00
Baseboard outlet, for appliances or floor lamps	3.70
Floor outlet, for appliances or floor lamps	5.80

For switch and mains $15 is added, and for a three-story house $10 extra. Incandescent lamps are not included in the estimate, which is for concealed work wherever possible, in accordance with underwriters' approval.

The offer applies only to single residences of the ordinary two and three-story Philadelphia type, which must be on the company's existing lines, and also applies only to contracts calling for more than six current-consuming outlets.

A typical installation and the cost of both wiring and fixtures is given in the pamphlet, as follows:

	Wiring	Fixture
Cellar—one ceiling outlet and snap switch	$ 4.74	none
Laundry—one ceiling outlet	2.00	none
Baseboard outlet for iron, washer, etc.	3.70	.....
Porch—Ceiling outlet and single control switch	5.24	$ 2.90
Kitchen—Ceiling outlet	2.00	3.50
Dining Room—Ceiling outlet and single control push button switch	5.24	.....
Baseboard outlet for appliance	3.70	13.50
Living Room—Ceiling outlet and switch	5.24	10.20
Upper Hall—Ceiling outlet and single control switch	5.24	2.50
Bathroom—Ceiling outlet	2.00	2.50
Upstairs Sitting Room—Ceiling outlet and switch	5.24	10.50
Two Bedrooms—Two ceiling outlets	4.00	13.70
Switch and mains	15.00	.....
Totals	$63.34	$59.30
Aggregate cost of wiring and fixtures		$122.64

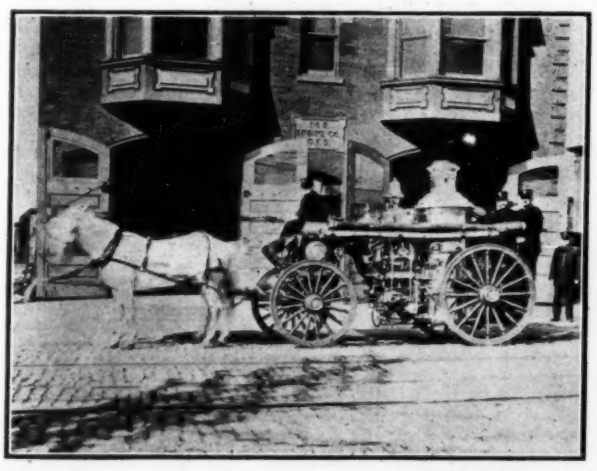
The campaign, which is meeting with marked success, is to run until January 1, 1917.

Projectors Light Outdoor Swimming Pool.

The city of Trenton, N. J., has created an outdoor swimming pool at the west end of the city, bordering Sanhican Creek. The pool is 600 by 450 feet and is fed from the creek.

As a means of night illumination, to enable the pool's use after dark, ten 250-watt projectors have been placed on 35-foot poles at the corners and sides of the pool. The units are so adjusted as to flood the whole water surface, providing safe conditions for the youth of the city to swim during the evening.

The installation was made by the Public Service Electric Company.



The Old and New in Fire-Fighting Apparatus.

The spectacular horse-drawn fire engine along with other fire-fighting apparatus is fast becoming obsolete and in its place the modern electric is being used. The illustration shows a converted horse-drawn engine now propelled by electricity. Note the position of the vehicle, illustrating effect of swivel joint relieving pumping mechanism of any under strain.

Details of a Successful Fan Campaign

Comprehensive Sales Effort by Texas Power & Light Company Results in 1913 Fan Sales—Advertising an Important Factor—Time Payments Allowed

By J. H. Moseley

THE following paragraphs describe in detail the publicity methods used in a recent electric fan campaign by the Texas Power & Light Company to make its customers and its employees familiar with the special fan placed on sale. In order that the conditions governing the campaign may be understood, it might be stated that this company operates by means of central plants or transmission system approximately 100 electric properties in cities and towns in the state. The population of these places range from 200 to 42,000 and are spread out over an area of over 90,000 square miles.

The territory is divided into 21 districts, each district being in charge of a local manager. The central town in each district was used as a distribution center and the other towns in the district were supplied from this center. Inasmuch as the company does not maintain a branch office in every town, sales were made in these towns by placing fans on display with their agent or collector. Advertising in the local paper was run over this collector's name.

On account of the largely scattered territory and the consequent necessity of paying traveling expenses for solicitors, the problem of securing a selling force large enough to conduct this campaign was one which required considerable thought. It had been found that men of the class desired could not usually be picked up locally, and it was finally determined to give the regular employees in the operating and clerical departments at these branches a chance to sell fans. This would give the employees chosen a chance to break into the commercial game and even though they should prove that they were not qualified for this kind of work permanently, it would give them an insight into the selling game and probably help them in their future relations with customers in connection with their regular work.

Accordingly a number of men were chosen by the managers of the several districts to act as fan salesmen during the campaign. This plan worked out well in some cases, but in other cases was an absolute failure. The employees selected were not, in every case, able to devote their entire time to the sales work and consequently the effort exerted was spasmodic and productive of poor results.

Advertising to Employees.

During the campaign one fact, already proven in other localities, was distinctly brought out. This fact is that there is a good field among a company's own employees for the introduction of electric appliances. Many employees while working for a central-station company and supporting the company's policy toward the use of appliances, are poor users themselves and consequently there is little wonder that the active assistance which a company receives from this source is small. This is one of the best possible fields to cultivate, for it means getting the employees enthused in regard to their own business and it will make them boosters of the business both during working hours and outside of working hours. Nothing will impress a customer more than the individual recommendation of an employee of the company who is a friend of the customer.

In order to interest the employees in the campaign and stimulate rivalry among the districts several issues of a weekly house-organ were published and a copy of each issue sent to all employees. This house-organ was published in the form of a small newspaper. Illustration from one of the issues is shown. This was called the "All-Green Heat Chaser," in order to secure as much publicity as possible for the special fan, which was called the "All-Green" fan, for reasons explained elsewhere.

Three issues of this "All-Green Heat Chaser" were

KEEP KOOL
With An
All
Green
Fan
THIS FAN
USES
Less Current
THAN THIS
60 WATT LAMP
$2.25 Cash—$2.00 a Month
FOR FOUR MONTHS, A TOTAL OF $10.25
Undoubtedly this is the greatest fan bargain ever offered in this city
And Remember
With every Fan purchased we will give absolutely Free an Electric Iron Coupon. This Coupon will be worth $1 on the purchase of an Electric Iron at the regular price of $3.50 provided all payments on Fan are completed on or before June 30.
We guarantee the "All-Green" to give satisfaction
"All-Green"
Just the Fan
12-Inch
Just the Size
No. 44

Two Advertisements Used by Texas Power & Light Company in Its Fan Campaign. A Large Number of Sales Were Due Directly to the Advertising, No Salesmen Being Employed in Several Districts.

EXTRA! EXTRA! EXTRA!

Published Just before the Hot Weather

The "ALL-GREEN" Heat Chaser

Price Your Co-operation

Vol. 1 May 15, 1916 No 5

An "All-Green" Fan Free to Employees

To every regular employee who secures residential orders for **10 or more** "All-Green" 12-inch Electric Fans between the dates of May 22 and June 3, inclusive, we will give FREE an "All-Green" fan with cord and plug.

In order to participate in this special offer to employees only, you must join the "Ten Club," by signing up with the Manager in your District on or before May 22, or fill in the card below and hand or mail to Manager in your District.

Managers, Dallas office employees and regular commercial employees not included in this offer.

JOIN THE "TEN CLUB" TODAY

Extra Edition of Company Magazine Making Offer to Employees.

published and one edition. These were mailed at intervals of one week, the last one being mailed so as to reach employees the Saturday preceding the opening of the campaign.

Great care was taken to play up the personal element in this publication and stimulate rivalry among the different districts. In order that all districts might be put on a comparative basis, a quota was set for each district. This quota was based on one fan sale for each ten customers and the standing of the different districts was computed as a percentage of this quota. The method of listing the districts is shown in the accompanying table.

A list of the several districts with the quota that they were supposed to sell was published and also a list of the names of all employee-salesmen.

Inasmuch as these publications were issued at the time the Mexican excitement was causing large headlines in all papers, the copy for these publications was modeled on the "War News" plan to a certain extent. Directions and suggestions as to the best way to sell the fans were also given.

As a culmination of this advertising to employees, an extra was issued offering a free fan to any employee (managers, general office employees and commercial department employees excluded) who would sell 10 or more "All-Green" fans to residential customers.

The general idea of this advertising to the employee was excellent and but for an unforeseen happening would have undoubtedly resulted in the sale of many fans. Unfortunately delays in shipment were experienced and the opening of the campaign was delayed approximately one week. Inasmuch as the advertising had been timed to stimulate employees so that the campaign would start off with a jump, the effect of the delay was a dying out of spirit among the local men, the sales effect of which can be easily imagined.

In spite of this handicap, however, employees in ten different districts received free fans for their efforts. A total of 25 fans were given away for this effort on the part of employees. One young lady employee sold 17 fans.

The employees of a company can do a wonderful amount of good by talking up these special sales and the importance of this field cannot be over-estimated.

Advertising to Consumers.

The consumer was reached through the medium of monthly bills and through the newspapers. The use of cartoon films was also considered, but was abandoned on account of the inability to get the films in time for the campaign.

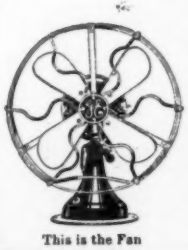
Two circulars were sent out, with customers' bills. One of these is here reproduced.

The fan selected for the campaign was a standard type fan manufactured by one of the large manufacturers. This fan had steel blades and guard instead of the usual brass blades. These parts, as was the entire fan, were enameled in olive green, and on account of this special feature the fans were called "All-Green." This name was used consistently throughout the campaign and there is little doubt but that the company will derive considerable benefit next year from the advertising done, provided a green fan is sold.

The fan was offered for $10.25 on terms of $2.25 cash and $2 a month for four months. With every fan an electric iron coupon was given away. This coupon was good for $1 on the purchase of an electric iron at the regular price, provided the customer completed all payments on the fan within a limited time. This really amounted to a cash discount on the fan. This plan met with poor success, due partly to the fact that the offer was a little too complicated for the ordinary individual to understand and due partly to the fact that many customers already had irons.

The writer was criticized several times for using the heading "$2.25 Places This Fan in Your Home," the objection being raised that this was a misrepresentation. This was not a misrepresentation, because all copy contained the total cost of the fan, and there was no possibility that a misunderstanding could arise on this point. However, there are so many ways of playing up this proposition that it might be well to state the matter in different words and thus eliminate any possibility of come-back from the customer.

$2.25 Will Place This Electric Fan In Your Home



This is the Fan

To secure a price which will place an Electric Fan in every home, we have contracted to take from one manufacturer alone, more than five (5) carloads of standard 12-inch desk fans in one shipment.

Think of it! More Than Five Carloads of 12-inch Fans!!

This 12-inch fan is to be made for us by the General Electric Co. It can be used on wall or desk and the breeze can be diverted in any direction. The base is "Anti-Creep." The fan has 3 speed controls. All parts are enameled a Dark Olive Green; hence it will not spot, tarnish nor show dust or dirt.

This 12-inch desk fan will operate at full speed with less electricity than it takes to light a 60 Watt Mazda Lamp.

Think of it! Less than 60 Watts!!
See this fan in operation at our office TODAY.

(Over)

.....1916

Texas Power & Light Company, City.

Dear Sirs:

If you will deliver to me one of your Standard four-blade, enameled electric fans with cord and attachment plug, described in your circular, I agree to pay you therefor $2.25 upon delivery and $2.00 a month additional on the first days of June, July, August and September, 1916, with the privilege of returning the fan within two weeks after delivery and receiving my money back. Upon my failure to make any of the above payments, you may retake possession of the fan at any time.

Yours very truly,

Name .....

City..... Street Address.....

...s reserved by above agreement will be delivered after April 22, 1916.

Two Sides of a Double Mailing Card Sent to All Prospects. Many Orders Were Received on These Cards.

Every Available Vehicle Had to Be Pressed Into Service Delivering Fans.

The first circular sent to customers was in the form of a double post-card. A part of this advertisement called attention to the various parts of the fan and the other part constituted an order for a fan when signed by the customer. This card was sent out a month in advance of the date of the campaign and brought enough direct orders to pay for itself many times over. This was followed up the next month by an announcement of the opening of the campaign.

Four newspaper advertisements were used. The newspaper copy was directed to the housewife and was educational copy intended to show how the fan could be used and just what it would do. The entire advertising campaign was centered around the cut of the fan and lamp which stated, "This fan uses less current than this 60-watt lamp." It had been found in the past that a large percentage of customers was ignorant of the real cost of operating a fan and the idea of the comparison of the fan and lamp was striking as well as simple. A number of comments on this advertising were received, showing that the simple method of picturing this fact was as effective as contemplated.

Window displays showing the fan in actual operation alongside of a 60-watt lamp were placed in show windows wherever possible.

Keeping Interest Aroused.

During the first two weeks of the campaign "Co-operative Lettergrams," giving data on sales, were sent out daily to all the districts. These were distributed to the men interested in the campaign and served to keep up the competitive spirit of rivalry among the branches of the same size.

This lettergram has a red heading and is printed on yellow paper, being the same size as a telegraph blank. It is at once distinguished from the rest of the mail and has been found very effective in producing results.

Contractors' Attitude.

This was the first attempt on the part of the company to sell appliances, this business having been left to the local contractor in the past. Few of them, however, have been inclined to properly push the sale of current-consuming devices and the company felt forced to go into this business to protect and develop its own interests. Before the campaign started the company notified all contractors of what would be done and offered a commission of $1 to all contractors for each "All-Green" fan they might sell during the campaign. This offer was accepted half-heartedly by a majority of the contractors and very eagerly by some. The offer was considered by the company to be a very liberal one, as the contractor would be required to make no investment at all and would not have to take any chance on bad credit risks.

Comparative Price Advertising Not Used.

This fan was not advertised as a $15 fan to be sold at $10.25 for a limited time, but all advertisements featured the price of $10.25 and stated that this was the best fan that could be purchased for the money. The company has tried to instil confidence in the consumer and has tried to make them feel that when a customer buys anything from the company he is getting his full money's worth.

Results Obtained.

The campaign has resulted in the sale of approximately $25,000 worth of electric fans and an addition of about $10,000 annual revenue. This includes only fans sold by the company. The campaign indirectly was the cause of many sales by contractors, as a 12-inch straight-type fan was the only type of fan sold. Quite a few customers who responded to advertising wanted oscillating fans and these were referred to local contractors.

FAN SALES IN VARIOUS DISTRICTS TO JULY 6.

District	Quota	Total Orders	Percent of Quota	District	Quota	Total Orders	Percent of Quota
Gainesville	106	204	192	Palestine	135	60	44*
Paris	175	191	109	Hillsboro	190	79	41*
Eagle Pass	71	63	89*	McKinney	131	52	40*
Bonham	138	109	78	Clebourne	214	72	34*
Taylor	134	105	78*	Denison	240	72	30*
Temple	297	188	63	Sherman	184	53	29*
Tyler	132	77	58*	Brownwood	130	38	29
Ennis	142	82	57	Waxahachie	168	47	27*
Wichita Falls	236	129	54*	Big Springs	57	11	19*
Commerce	45	23	51	Sweetwater	110	17	17*
Waco	486	241	49	TOTAL	3,545	1,913	53

"All-Green" 12 Inch Fan Sale Extended One Week to Saturday June 10
THIS FAN
USES
Less Current
THAN THIS
60 WATT LAMP
$2.25 CASH
Balance
$2.00 A Month
For Four Months
A TOTAL OF $10.25
Useful All Over the House
1. In The Kitchen
Place fan under kitchen table and operate at full speed. This will drive the heat up and out of the room. The strong breeze will not interfere with your work.
2. In the Dining Room
Place the fan so that the breeze will be directed just above the heads of persons seated. Direct the fan toward the kitchen door and operate at full speed. This will drive out the kitchen fumes and keep the dining room cool and pleasant.
3. In the Bedroom
Place the fan with back to an open window. Operate at medium speed. This will draw in fresh air and keep up a gentle breeze in the room all night enabling you to sleep cool and restfully.
4. For the Baby
Place fan so that breeze will be directed above "baby's" crib. Operate fan at low speed. This will provide a gentle breeze and keep "baby" from being fretful.
5. Drying Clothes
When necessary to dry clothes quickly, hang them up in open place and operate fan at full speed. Direct the breeze so it will play directly on clothes. Clothes can be dried very quickly in this manner.
6. In the Parlor
This fan operated at full speed in the parlor will provide sufficient breeze to keep your visitors cool and comfortable.
7. In the Winter
Operated at low speed with the breeze directed against the stove, an electric fan will increase the radiation from the stove and distribute the warm air all over the room.
Money Back Guarantee.
You may try one of these "All-Green" fans for two weeks. Try it in every room and see for yourself what it will do. If you are not satisfied with its performance return it to us and we will refund all money you have paid on it.
$1
With every Fan purchased we will give absolutely Free an Electric Iron Coupon. This Coupon will be worth $1 on the purchase of an Electric Iron at the regular price of $3.50 provided all payments on fan are completed on or before June 30.
$1
"All-Green"
Just the Fan
No. 41
12 Inch
Just the size

An Advertisement Announcing Extension of Campaign.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

WIRING FOR CONSTANT-POTENTIAL ARC LAMPS AND VAPOR LAMPS.

By Terrell Croft.

Multiple or constant-potential arc lamps operate in multiple as shown in Fig. 1, *A* and *B*, from constant-potential circuits.

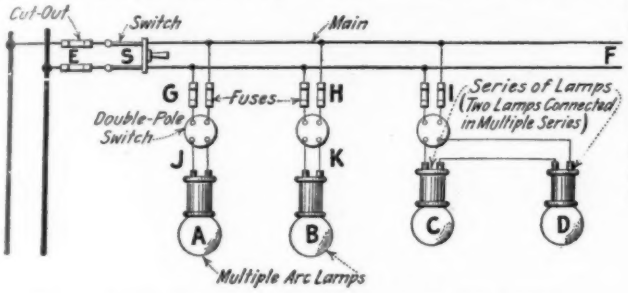


Fig. 1.—Arrangement of Cutouts for Multiple Arc Lamps.

In some cases groups of lamps are connected two or more in multiple-series across the circuit as indicated at *C* and *D*. This method is used particularly for flame arc lamps or for two lamps in series across a 220-volt circuit.

Wiring for Arc Lamps.

Each arc lamp or series of lamps served from a constant-potential circuit must be protected by a fuse, as shown in Fig. 1. The multiple lamps *A* and *B* are protected respectively by the fuses *G* and *H*. The lamps *C* and *D* in multiple-series are protected by the fuses *I*.

Provision for large starting current must be made in arranging circuits for arc lamps. At the instant the lamp starts, the carbons are together and would, if it were not for the fact that there is always a ballasting resistance or its equivalent in series with the arc, create a dead short-circuit. In any case, the initial current is relatively great. Furthermore, the feed mechanisms of these lamps sometimes "stick" and currents of considerable intensity then flow through the lamps for extended periods. Hence, the branch circuits, as for example, *G J* and *H K* in Fig. 1, should always be capable of carrying a current (in accordance with the values of Code rule 18) 50 per cent greater than the normal operating current required by the lamp. If this excess conductor capacity is not provided, there is always a tendency to overfuse the conductors so that they will pass the starting current. Where a main, for example *E F*, Fig. 1, feeds a number of arc lamps which may all be switched in or out of circuit at the same instant by the switch *S*, the conductors of such a main should preferably also have 50 per cent excess current-carrying capacity.

Resistors or regulators for arc lamps are usually mounted within the metal casings of the lamps but frequently they are, as shown in Figs. 2 and 3, arranged as separate units. Where such construction is used, the casing inclosing the resistor must always be so arranged that it is not adjacent to inflammable material. These resistors may under certain conditions become hot enough to originate a fire.

To prevent interference by the unauthorized, all arc lamps should be installed high enough above the ground or floor so that they cannot be reached without a ladder. Experience has shown that this provision may obviate much trouble.

Stranded leads should be provided for lamps that are to be raised and lowered. That is, the leads should be flexible because leads of solid wire will be strained by the bending action, as the lamp is raised and lowered and as the relatively long loops swing back and forth in the wind, and will ultimately break.

A good method of hanging arc lamps is shown in Fig. 4, wherein the lamp is supported by a conduit hanger through

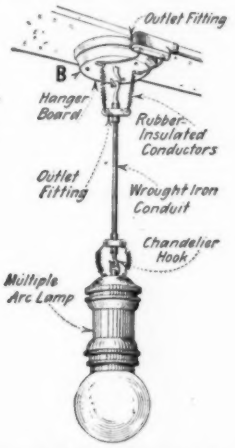


Fig. 4.—Substantial Arrangement of an Arc Lamp.

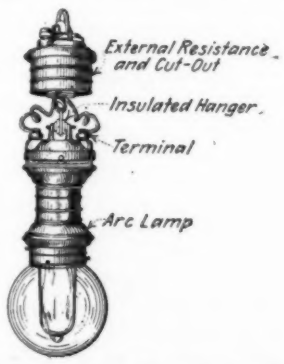


Fig. 2.—Multiple-Series Arc Lamp Equipped with External Resistance and Cutout.

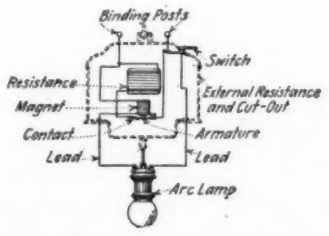


Fig. 3.—Connections of Automatic Cutout and Resistance for Power-Circuit Arc Lamp.

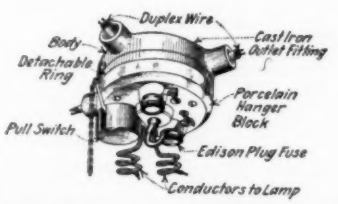


Fig. 5.—Multiple-Arc-Lamp Hanger Block Arranged on Special Fitting.

which the conductors pass and which is at each of its ends fitted with an approved outlet fitting. Porcelain hanger blocks, similar to that illustrated in Fig. 5, can frequently be utilized to advantage. These can be procured either with or without fuse receptacles, and with or without switches. They provide a very compact and rugged arrangement.

Wiring for Mercury-Vapor Lamps.

Mercury-vapor lamps consist, as shown in Fig. 6 and diagrammed in Fig. 7, of a glass tube which contains a vapor

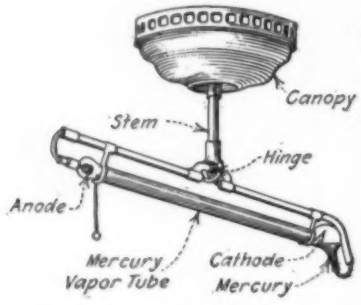


Fig. 6.—Single-Tube Mercury-Vapor Lamp.

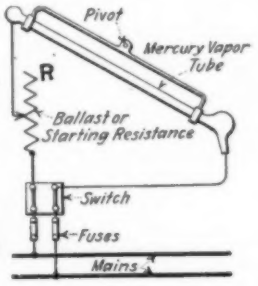


Fig. 7.—Wiring for a Single-Tube Mercury Lamp.

of mercury. When an electric current is forced through this vapor it becomes luminous, emitting a light of a greenish color. To start the tube it is necessary to tilt it, permitting the mercury in the cathode bulb to bridge between the cathode and the anode. A resistance, *R* in Fig. 7, or its equivalent, is provided to limit this starting current and to vary the current taken by the tube. Figs. 6 and 7 illustrate but one of many possible forms. Where great intensity of light is required a number of tubes may be arranged in one bank to form a lighting unit.

In wiring for mercury-vapor lamps each tube or each series of tubes, when a number are mounted in a single frame, should, as shown in Fig. 7, be protected by fuses. A double-pole switch should be provided. In no case should more than five tubes be fed through a set of fuses.

Wiring for Moore Tubes.

The Moore tube system is a high-voltage vacuum-tube lighting system which has been used to some extent, particularly for advertising. It is illustrated diagrammatically in Fig. 8. A continuous clear-glass tube *ABCDEF*, usually 1.75 inch in diameter, is arranged around the ceiling of the room to be illuminated. The tube may have a length of only a few feet, or it may be of a length as great as 200 feet. The tube has within it rarefied air or a non-metallic gas. When a high

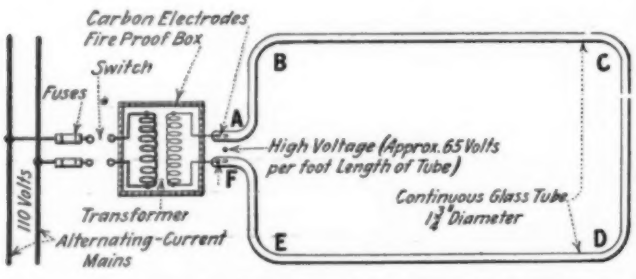


Fig. 8.—Diagram of a High-Potential Vacuum-Tube System.

voltage is impressed on the ends of the tube, as at *A* and *F*, Fig. 8, the rarefied gas within the tube glows and gives forth light. Where the tube has a rarefied air filling, the light is pink, but other lights can be produced by using different gases within it. The voltage required across *AF* for a tube 100 feet long is 7,150 volts. For a 150-foot tube a pressure of 9,750 volts is required and for a 200-foot tube 12,250 volts pressure is required. These tube systems operate satisfactorily only on alternating current, because the high voltage required cannot be obtained readily with direct current. The high voltage impressed across the tube terminals *AF* is developed with a step-up transformer having a low-tension voltage of 110 or 220.

The inclosure for the step-up transformer used with the Moore vacuum-tube system is, as provided by the manufacturers, of metal and therefore noncombustible. The auxiliary apparatus otherwise conforms to the requirements outlined by the National Electrical Code.

In wiring for a high-potential vacuum-tube system the circuit may be arranged about as shown in Fig. 8. Each tube should be controlled by a double-pole switch and protected by a cutout.

CONTRACTORS ORGANIZE FOR HOUSE WIRING IN TRENTON.

Co-Operative Efforts During House Wiring Campaign Productive of Excellent Results.

Excellent results, promoting the electrical contracting and central-station industry at Trenton, N. J., have been brought about as a result of the closer co-operation of the contracting firms among themselves and with the central station, the Public Service Electric Company of New Jersey.

During the "Wire-Your-Home Month" the past spring, L. T. R. Ward, Jr., in charge of the company's new business, conceived the idea of an organization of contractors, with the result that the "Electric Club of Trenton" was formed with about fifty members, comprising jobbers, contractors and Public Service company men.

The club has been holding regular meetings twice a month, at the office of the central-station company on State Street.

The following are the club officers: President, J. P. Kelly; vice-president, Arthur J. Bennett; secretary, Samuel H. Smith; treasurer, Fred A. Schultz.

House-Wiring Campaign.

During the "Wire-Your-Home Month" the contractors came to an agreement on approximate prices, per outlet and per switch, to be used as the basis for making estimates and bids on wiring jobs. These prices are $3 per outlet, $3 per baseboard receptacle, $3 for each flush switch and $3.50 each for a set of three-way switches. The service pipe, meter board and connections is charged for at $10 per service.

Public Service company agents made a thorough canvass of the territory, using the above prices as a basis for their rough estimate of what each job would cost the houseowner. Where prospects showed interest in the proposition the company got two or three contractors, selected with due regard to a fair apportionment of the business, to call on the prospect and submit definite estimate. It was preferred that the customer select his own contractor, however, and the company acted, in this connection, only when the customer expressed no preference. From the bids submitted, the prospect was at liberty to make his own award, dealing directly with the contractor, the Public Service company doing no financing.

Special advertising was placed in all daily newspapers, and on special occasions the Public Service Electric Company used about one-quarter page, local contractors filling the remainder of the page. A large electric sign reading "Wire Your Home" was erected on a building front in a conspicuous location and was financed by the Club.

The immediate return was the securing of 100 new contracts in 30 days. It is the plan to continue the work steadily throughout the year. Results are amply justifying the creation of the local organization, which clearly has had the effect of producing more cordial relations between men in the electrical industry and has eliminated the "cut-throat" spirit of competitive bidding.

Polyphase Motor Windings

By Justin Lebovici

This is the first installment of a new article which continues the series started by Mr. Lebovici in the issue of April 22. Polyphase windings of different types will be considered, closed two-layer wave windings being first taken up. Later in this article single-layer windings and windings for two speeds will be described, special attention being given to the mechanical design of the windings. The descriptions and explanations are supplemented by numerical examples which are worked out and illustrated.

It has been explained in a previous article that the phases of a polyphase winding must be displaced around the iron core by the same angle by which the electromotive forces, applied to their terminals, are displaced in time. Since any one phase of a polyphase winding has all the characteristics of a single-phase winding, the former can be considered as resulting from the placing of several single-phase windings side by side. All that has been said in the previous article in regard to the single-phase windings applies equally well to each phase of a polyphase winding.

Continuous lap or multiple windings and wave windings are the types most frequently used in the stator and rotor of medium-sized alternating-current motors. These windings are composed of diamond-shaped coils, with two coil sides in one slot, the coils being connected in the proper manner to give a polyphase winding. Bar windings, with one or two bars per slot, are used in low-voltage, high-current machines. In large, high-voltage machines "concentric" windings are most frequently used. "Basket" windings are used in low-voltage machines when the coils are composed of a large number of turns of small wire. In single-phase commutator motors, the windings of the rotor are largely of the type used in the armatures of direct-current machines and these windings may be considered as "mesh"-connected polyphase windings of the same number of phases as there are commutator bars, or sections, per pole.

We shall discuss the polyphase windings in the following order:

1. Lap or wave winding (two-layer windings).
   - (*a*) Closed windings.
   - (*b*) Open windings.
2. Windings with one coil side per slot (single-layer windings).
3. Induction-motor windings for two speeds.
4. Squirrel-cage windings.

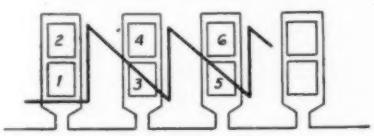


Fig. 1.

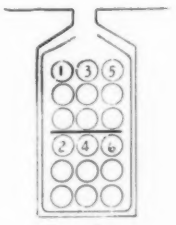


Fig. 2.

Lap or Wave Windings.

Closed or continuous windings.—The arrangement of the coils in the slots, and the connection of the coils, is shown by means of a "winding diagram." The following discussion of formulas developed by the late Professor Arnold will be of assistance in laying out winding diagrams.

These formulas are based on a definite method of numbering the conductors of coil sides. Fig. 1 shows three slots of a stator having two coil sides in each slot. Fig. 2 shows a rotor slot of a commutator motor having three single coils side by side, each single coil having three turns. The conductors are so numbered that in following the conductors in numerical order, we follow a zig-zag line as indicated in Fig 1. All outside conductors have an odd number, while all inside conductors have an even number. In case there is only one conductor per slot, the conductors are numbered consecutively. Commutator bars are numbered consecutively in a clockwise direction.

Fig. 3 shows one coil, or winding element, of a wave winding. The shaded areas represent the poles of the machine. τ is the pole pitch. y_1 is the "forward pitch" or "positive pitch" of the coil on the rear side (the side opposite the end where the connections between coils are made, or, the side opposite the commutator in a commutator machine). y_2 is the "backward" or "negative" pitch of the coil on the front side (the connection or commutator end). y is the resultant winding pitch.

We shall indicate by S the number of conductors or coil

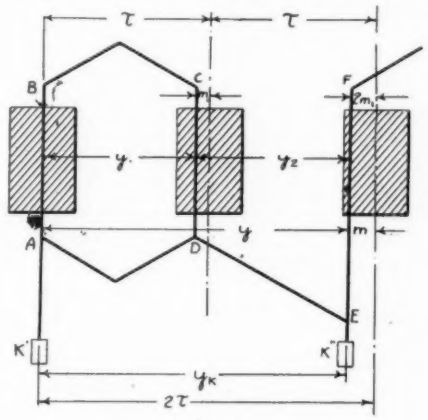


Fig. 3.

sides in the conductor diagram. The number of coil leads is also equal to S. In a commutator motor there are two leads brought to each commutator bar; hence, if K is the number of commutator bars, we have, for a drum type of winding, the relation

$$S=2K \qquad (1)$$

In Fig. 3 it will be noted that the coil pitch y_1 differs from the pole pitch τ by an amount indicated by m_1. Similarly, with leads brought to commutator bars K' and K'', the commutator pitch y_K differs from twice the pole pitch τ by an amount indicated by m.

We then have the following relations (see Fig. 3):

$$y=y_1+y_2=2\tau-2m_1$$
$$y_K=2\tau-m.$$

Fig. 4 is the same as Fig. 3, except that it shows the case where the coil pitch y_1 is larger than the pole pitch τ.

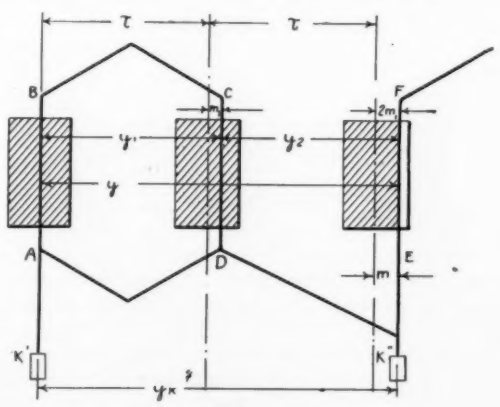


Fig. 4.

We can write, for wave windings in general, the following relations:

$$y=y_1+y_2=2(\tau\pm m_1) \quad \text{.....(2)}$$
$$y_k=2\tau\pm m \quad \text{.....(3)}$$

Figs. 5 and 6 represent coils, or winding elements, of a lap winding. The notation is the same as used in Figs. 3 and 4. Following the winding in Fig. 5 in the direction $K'ABCDK''EF$ we advance in a clockwise, or positive, direction by an amount m_1. Assuming in Fig. 4 conductor AB to be under the center of the pole, we advance to the right by an amount m_1 under the same pole. Then CD is displaced with reference to the center of the next pole by an amount m_1 and EF is displaced

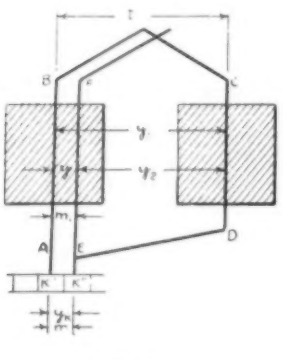


Fig. 5.

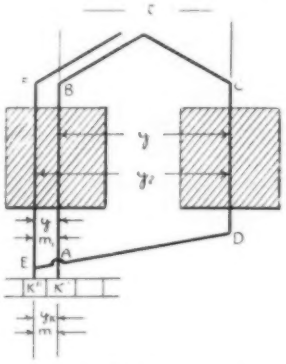


Fig. 6.

with reference to the center of the pole by an amount $2m_1$. The displacement in the field of two consecutive coil sides, represented by m_1, will be called the *field displacement.*

In Figs. 3 and 4 the field displacement m_1 is equal to the difference between the coil pitch and the pole pitch or

$$m_1=y_1-\tau \quad \text{.....(4)}$$

It is readily seen that when m_1 is positive we follow the winding $ABCDEF$ in a clockwise direction and such a winding is called a progressive winding. Similarly when (4) gives a negative value for m_1 we follow the winding in a counter-clockwise direction and such a winding is called a *retrogressive winding.*

In the lap windings shown in Figs. 5 and 6 the field displacement m_1 is equal to the difference between y_1 and y_2 and is also equal to the resultant winding pitch and we have the following relation for lap windings:

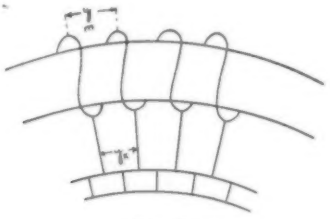


Fig. 7.

$$m_1=y=y_1-y_2 \quad \text{.....(5)}$$

The values τ, y_1, y_2, y, and m_1 may be measured either by units of length (inches, centimeters, etc.) or by the number of conductors or coil sides spanned. If p represents the number of pairs of poles in the machine and D represents the diameter of stator or rotor, we can write

$$\tau=\pi D/2p$$
or $$\tau=S/2p$$
or $$\tau=K/2p \quad \text{.....(6)}$$

In the case of a machine having K commutator segments, the variation of the commutator pitch, y_k, from twice the pole pitch, 2τ, is equal to the field displacement m as shown in Fig. 4.

Formulas (2) and (3) may then be written:

$$y=y_1+y_2=S/p\pm 2m_1 \quad \text{.....(2)}$$
$$y_k=K/p\pm m \quad \text{.....(3)}$$

The quantities y_1, y_k, and m are illustrated in Fig. 7 for the case of a ring winding.

Number of circuits in a closed winding and the relation to the field displacement.—A ring-type armature, driven in a clockwise direction in a four-pole field, is represented in Fig. 8. There are S coils on this armature or $S/2p$ coils per pole. Electromotive forces are induced in these coils in the directions indicated in the figure. The direction of the electromotive force in any one coil changes as the coil passes from pole to pole. In the groups AB, BC, CD and DA in Fig. 8, the electromotive forces of all coils of a group are in the same direction and we will consider each one of these groups as a separate

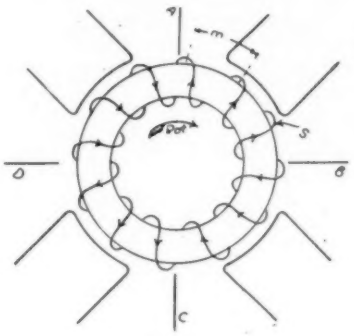


Fig. 8.

circuit. In following the winding from A to B we touch S_1 coils and the total field displacement is S_1m. If we call the total number of circuits $2a$ we then have

$$S/S_1=2a$$

and since $S_1m=S/2p$ it follows that

$$S/S_1=2mp=2a$$
or $$a=mp \quad \text{.....(7)}$$

In the case of an armature with commutator the points A, B, C, D in Fig. 8, are the points at which the brushes must be placed for the collection or introduction of current. Equation (7) is important because it shows the relation between the field displacement, the number of pairs of poles and the number of pairs of parallel circuits in a closed winding.

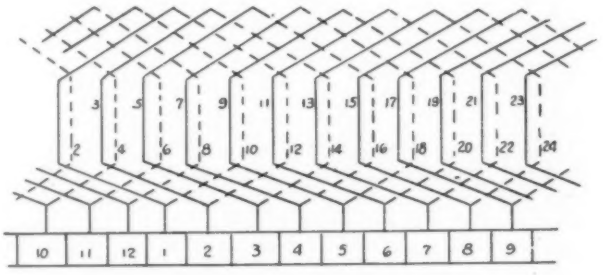


Fig. 9.—Winding Diagram for Example No. 1.

General Winding Rules for Closed Windings.

If we substitute from (7) in (2) and (3) we have

$$y=y_1+y_2=S/p\pm 2a/p=(S\pm 2a)/p \quad \text{.....(8)}$$
$$y_k=K/p\pm a/p=(K\pm a)/p \quad \text{.....(9)}$$

Referring to Fig. 1 and remembering that a coil is made up of a bar at the top of one slot (odd numbered) and a bar in the bottom of another slot (even numbered), it follows that y, *and* y_2 *can only be odd numbers.*

Equation (8) gives the sum of y_1 and y_2 and this must be a whole, even number. In a full pitch winding y_1 and y_2 will be nearly equal, while in a short pitch winding y_1 will be smaller, and y_2 larger, than $y/2$ by the same amount.

Equation (8) will apply in the case where the winding is not connected to a commutator. For windings connected to commutators it will be necessary to apply both equations (8) and (9).

We have the following general rule, referring to Fig. 3. *Connect conductor x (A B in Fig. 3) with conductor x $+y_1$ (CD in Fig. 3) on the rear side, and conductor $x+y_1$ with conductor $x+y_1+y_2$ (EF in Fig. 3) on the front side.*

For windings connected to a commutator we have the following additional rule. *Connect commutator bar K' through a coil to commutator bar $K'+y_k$ (K" in Fig. 3).*

For simple multiple windings it will suffice to remember (see Fig. 5) that y_1 is approximately equal to the pole pitch and that

$$y=y_1-y_2=\pm 2 \quad \text{.....(10)}$$

$$y_k=\pm 1 \quad \text{.....(11)}$$

and that, in general,

$$y=y_1-y_2=\pm 2m \quad \text{.....(12)}$$

$$y_k=\pm m \quad \text{.....(13)}$$

We will apply the above formulas to several practical examples, before proceeding further.

Example No. 1.

The winding of a two-pole machine, having 12 slots and 12 commutator bars and 2 coils per slot, is to be connected to form a progressive lap winding.

There are 12 slots and 2 single coils per slot. From equation (1)

$$S=2K=2\times 12=24$$

Hence $\tau=S/2p=24/2=12$

Since y_1 is approximately equal to τ and is an odd number, we shall chose $y_1=11$. For a progressive winding $y=+2$ or $y_2=y_1-2$, hence in our case $y_2=11-2=9$. To sum up

$$y_1=11 \quad y_2=9 \quad y=2 \quad y_k=1$$

Starting from commutator segment 1 we go to conductor 1, from conductor 1 to conductor $1+y_1$ or conductor 12, from conductor 12 by way of commutator segment $1+1=2$, to conductor $1+y_1-y_2=3$ and so on.

Tabulating we obtain Table I.

TABLE I.

Commutator Segment.	Conductor.	Conductor.
1	1	12
2	3	14
3	5	16
4	7	18
5	9	20
6	11	22
7	13	24
8	15	2
9	17	4
10	19	6
11	21	8
12	23	10

It will be noted that the difference between numbers in the commutator-segment column is equal to one and the difference between numbers in the conductor column is equal to two. The winding diagram is laid out in Fig. 9. For actual shop practice it is sufficient to specify that *the coil lies in slots one and six and connects commutator bars one and two.*

Slot Pitch: In the same way as we measured the pole pitch in units of length or in terms of the number of conductors, we can also measure the slot pitch y_n either by dividing the circumference by the number of slots or by dividing S by the number of slots. If we call Z the number of slots, the slot pitch

$$y_n=S/Z$$

In case there are four or more conductors or coil sides per slot, it is necessary, if the top and bottom side of the coil shall be together in one slot, to make the coil pitch y_1 a multiple of the slot pitch plus one, or

$$y_1=\text{whole number} \times y_n+1 \quad \text{.....(14)}$$

Example No. 2.

A four-pole machine has 20 slots and 40 commutator bars. Lay out a winding diagram for this machine assuming that the winding is to be lap, short-pitched, and that it is shop practice to wind all armatures retrogressive.

Using the same notation as before we have:

$$Z=20$$

$$S=2K=2\times 40=80$$

$$\tau=S/2p=80/(2\times 2)=20$$

$$y_n=S/Z=80/20=4$$

y_1 is to be smaller than τ (short pitch) and must be a multiple of four plus one. We choose

$$y_1=4y_n+1=16+1=17$$

$$y_2=y_1+2=19$$

$$y_k=-1$$

Applying the general rules, we connect commutator segment 1, through a coil to commutator bar 40, and conductor 1 to conductor $1+y_1=18$ on the rear end, and conductor 18 to conductor $80+18-19=79$ by way of commutator segment 40, and so on.

Tabulating we obtain Table II.

TABLE II.

	Commutator Segment.	Conductor.	Conductor.
	1	1	18
A_1	40	79	16
	39	77	14
	38	75	12
	37	73	10
	36	71	8
	35	69	6
	34	67	4
	33	65	2
	32	63	80
	31	61	78
B_2	30	59	76
	29	57	74
	28	55	72
	27	53	70
	26	51	68
	25	49	66
	24	47	64
	23	45	62
	22	43	60
	21	41	58
A_2	20	39	56
	19	37	54
	18	35	52
	17	33	50
	16	31	48
	15	29	46
	14	27	44
	13	25	42
	12	23	40
	11	21	38
B_1	10	19	36
	9	17	34
	8	15	32
	7	13	30
	6	11	28
	5	9	26
	4	7	24
	3	5	22
	2	3	20

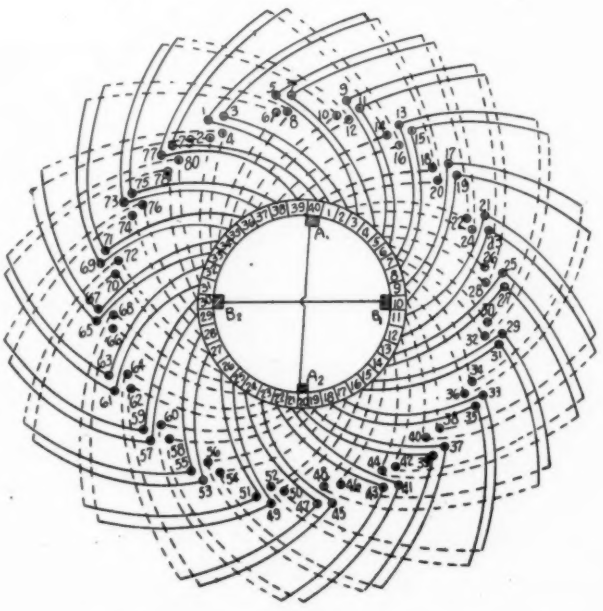
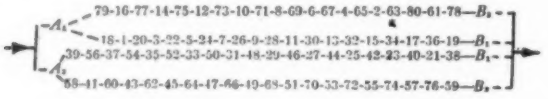


Fig. 10.—Winding Diagram for Example No. 2.

The electromotive forces induced in each coil side are shown in Fig. 10 by means of crosses and dots. We see that at commutator bars 40, 10, 20 and 30 the direction of flow of the resulting current changes. In consequence of this, it we desire to collect or introduce a current at the commutator, it is necessary to apply brushes at these points. In Fig. 10 we have four poles and four brushes, that is, the number of brushes is equal to the number of poles.

Brushes 40 and 20 and brushes 10 and 30 can be intercon-

nected. If we connect the brushes A_1 A_2 to one line and brushes B_1 B_2 to the other line, the current will distribute itself in the winding (Fig. 10) as follows:



Each circuit contains 20 coil sides or 10 coils and the current is distributed equally among the four circuits. If the circuit A_1 B_2 had more coils than circuit A_1 B_1 there would be an unbalance in voltage between these two circuits and a large current would flow in the circuit A_1 B_2 B_1 A_1. Hence, it is necessary that each circuit be composed of the same number of conductors. This condition is fulfilled when the number of slots is divisable by the number of pairs of poles, that is, when Z/p is a whole number.

It is characteristic of the multiple windings treated in examples 1 and 2 that the number of brushes and the number of parallel circuits is equal to the number of poles.

In these examples we have selected a field displacement on the commutator equal to one, and from equation (7) it follows that

$$a=mp \text{ or } a=p$$

or the number of circuits equals the number of poles.

If we follow the windings shown in Figs. 9 and 10, starting with conductor 1, we return to the starting point after we have touched every conductor. A winding of this kind is called a "simplex" winding. Fig. 9 represents a two-pole, lap, simplex winding. Fig. 10 represents a four-pole, lap, or multiple simplex winding.

The effect of the "chorded" or short-pitched winding can be seen in Fig. 10, where the current flowing in the two coils of some slots are in opposite directions, thus reducing the armature reaction around those slots. In order to calculate the total electromotive force of one circuit we may proceed as before by considering the winding as a full-pitch winding and multiplying the result by a factor depending on the pitch.

figures determined above. The remainder of the table is obtained by adding or subtracting as shown, one for the commutator-segment columns and two for the conductor or coil-side columns. We add in the case of a progressive winding and subtract for the case of a retrogressive winding.

TABLE III.

Commutator Bar.	Conductor.	Conductor.
1	1	18
52	103	16
51	101	14
50	99	12
49	97	10
48	95	8
47	93	6
46	91	4
45	89	2
44	87	104
43	85	102
42	83	100
41	81	98
40	79	96
39	77	94
38	75	92
37	73	90
36	71	88
35	69	86
34	67	84
33	65	82
32	63	80
31	61	78
30	59	76
29	57	74
28	55	72
27	53	70
26	51	68
25	49	66
24	47	64
23	45	62
22	43	60
21	41	58
20	39	56
19	37	54
18	35	52
17	33	50
16	31	48
15	29	46
14	27	44
13	25	42
12	23	40
11	21	38
10	19	36
9	17	34
8	15	32
7	13	30
6	11	28
5	9	26
4	7	24
3	5	22
2	3	20

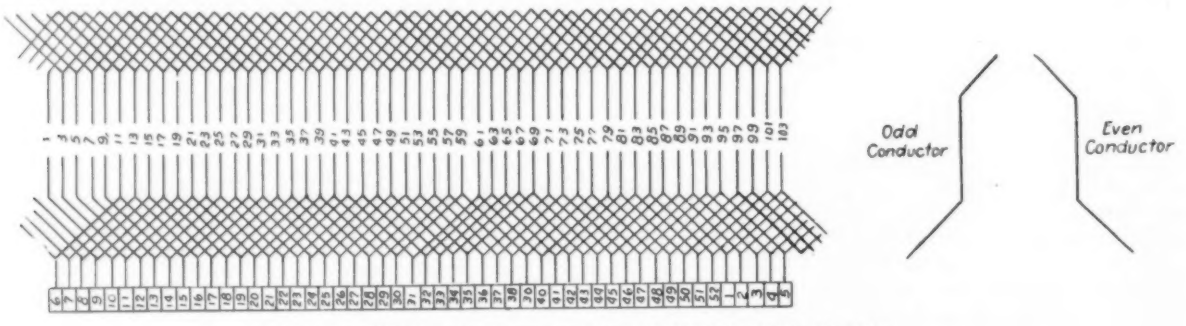


Fig. 11.—Winding Diagram for Six-Pole Machine With 52 Slots.

Example No. 3.

Lay out a winding diagram for a six-pole machine having 52 slots and 52 commutator bars. The winding is to be a full-pitch wave winding and due to certain conditions of design a two-circuit winding is to be used, that is, $a=1$.

Applying formula (1) $S=2\times52=104$
$y_R=104/52=2$
Applying formula (8), $y=y_1+y_2=(104-2)/3=102/3=34$
$y_1=17$ $y_2=17$
Applying formula (9) $y_R=(52-1)/3=17$
Applying formula (14) $y_1=8\times2+1=17$

Applying the general rules given before we proceed as follows. Connect coil side 1 to coil side $1+y_1=1+17=18$ at the rear side, and coil side 18 to coil side $18+y_2=18+17=35$, and connect commutator bar 1 through a coil to commutator bar $1+y_R=1+17=18$, and so on. The result is tabulated in Table III, which is computed in the following manner. There will be as many vertical columns for coil sides as there are poles, and as many vertical columns for commutator bars as there are pairs of poles. In the first horizontal line we enter the

This winding is laid out in Fig. 11. In specifying the winding it is not necessary to make up Table III or draw up Fig. 11 but they are included here to assist in arriving at an understanding of the winding under consideration. Table III will be of assistance not only in making up Fig. 11, but also in case taps are to be brought out from the winding for purposes which will be considered later. The winding given in Fig. 11 is fully specified for the shop by stating that *the coil lies in slots* 1 *and* 9 *and connects commutator bars* 1 *and* 18.

The above examples show the application of the winding formulas to concrete cases. Other examples will be given in the next issue.

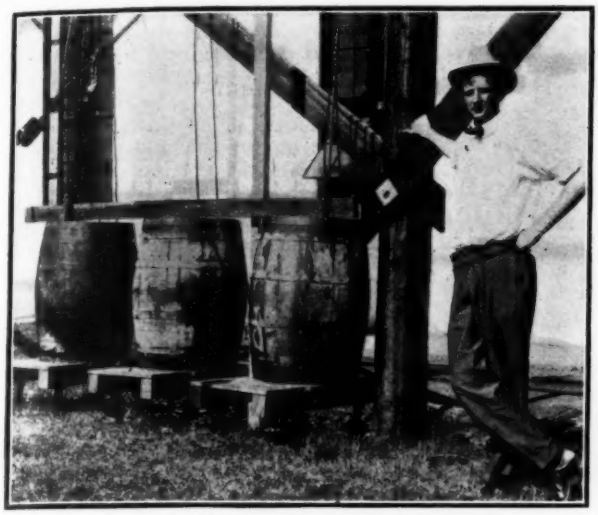
(To be continued.)

Motor-Driven Washer in Chinese Laundry.

That the Celestial is not insensible to the advantage of labor-saving machinery is attested by the fact that a one-horsepower electric motor has recently been installed by the Ayer (Mass.) Electric Light Company in a Chinese laundry, to operate a washing machine.

Emergency Water Rheostat Installation Prevents Delay Due to Slow Shipment.

The illustration herewith shows a water-barrel rheostat which is now being used as a starter for a large motor on a railway motor-generator set, pending the arrival of the



An Emergency Rheostat.

compensator, prompt shipment of which could not be obtained.

It was necessary to get the set in service immediately, and, inasmuch as the shipping promise on the compensator involved a long wait, and since no other starter could be obtained, Martin Rubey, the gentleman shown in the picture, took the matter in his own hands and produced the rheostat shown. This has been used in an emergency situation following the recent fire at Paris, Texas. The installation is for a 2,300-volt motor.

Simple Tool for Small Commutators.

A tool for sandpapering and cleaning small commutators can be made of an ordinary lead pencil in the following manner: Remove rubber eraser from the holder. Saw off holder and remove stump of wood from it, then shove down end of remainder of pencil so that rubber holder will slip on easily. Shove two sides of pencil end flat and fold a small piece of sandpaper over the end of pencil and then slip rubber holder over end to hold it in position. The tin holder must be made to slip back on the wood far enough to avoid short-circuiting commutator.

D. J. Harley.

Licensing Bill Proposed for Georgia.

A bill providing for the creation of a state board of electrical examiners has been prepared for introduction into the Georgia legislature, which is now in session, and will be considered by that body within the next few weeks. The title of the bill is as follows: "An act to create a state board of electrical examiners, to prescribe their duties and compensation; to require all persons, firms or corporations who shall install wiring apparatus or appliances for electric light, heat or power purposes within buildings in the state of Georgia to obtain a license from such board; to provide penalties for installing," etc.

The board is to be appointed by the governor and shall consist of a master electrician, a representative of a fire insurance company, an electrical inspector and an electrical engineer of at least ten years' standing, who are to be paid $6 per day each for each day's actual work. Every concern engaged in electrical contracting shall be examined, paying $50 a year for the license. In case of a firm or corporation, this examination shall be given to a member or employee in charge of the department of installation. A special permit may be granted to a journeyman electrician to do maintenance work for an owner on his own premises, this applying to the electrician of a factory or office building. Electricians attached to theatrical companies may do whatever work is necessary in this connection without a license, if it is done under the direction of another journeyman holding a special permit. The board shall have the power to revoke a license after a hearing and shall have the power to subpoena witnesses, administer oaths, and in all respects, have the authority of a tribunal.

Among the Contractors.

E. D. Sidenberg has opened an electrical store at 921 Franklin Street, Santa Clara, Cal.

The Lyman Electrical Company has opened for business at 106 North California Street, Stockton, Cal.

H. B. Lucas has purchased the stock and business of the Rodgers Electrical Company at Owensboro, Ky.

P. W. Schroeder has opened an establishment in Rhinelander, Wis., where he will handle electrical supplies and do contracting.

George Williams, Newark, N. J., has been awarded a contract for electrical work at Public School No. 5, Kearny, N. J.

H. W. Koehn has established an electrical supply and contracting business in Clintonville, Wis.

The Winton Motor Car Company has awarded a contract for electric work in its new $65,000 garage under construction in Seattle, Wash., to Meacham & Babcock, of Seattle, for about $1,000.

W. D. Brown, Waukegan, Ill., is finishing the construction of a 300-kilowatt power plant for the Reisse coal dock and has the contracts for the electrical work for nine two-flat buildings in Waukegan.

T. B. Ivy has sold his interest in the Chapman Plumbing & Electric Company, Argenta, Ark., to B. F. Medlock, who, with P. H. Chapman, will continue the business.

The Foster Electric Company and E. M. Raetz & Company, of Rochester, Minn., have been consolidated, the new firm to be known as the Foster-Raetz Electric Company. The two stores, one at 222 South Broadway, and one at 117 South Main Street, will be maintained as formerly, though the offices of the new firm will be at the latter store.

M. T. Petersen, of Madison, Wis., has entered the electrical contracting and repairing business under the name of M. T. Petersen Electric Company, and will carry a full line of supplies at 20 North Webster Street. One of his recent contracts was for wiring and installation of 27 motors in the new building of the French Bakery Company.

The Harloff-Loprich Electric Company, 109 North Hamilton Street, Madison, Wis., was organized this year by Otto Harloff and Karl Loprich. This firm is doing a general electrical business and carries a full line of supplies. It now has contracts ahead sufficient to keep its men working for at least two months.

THE DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-Keeping for the Dealer in Electrical Goods

HOW TO KEEP THE ELECTRICAL BUSINESS IN THE FAMILY.

Giving Methods How the Electrical Dealer and Contractor May Build Up and Hold Trade.
By Gordon C. Keith.

It must be evident to the electrical dealer and contractor that the hardware store, the drug store, the novelty store and the department stores are actively pushing electrical appliances and are endeavoring to work up a profitable electrical sideline business for themselves. If this electrical opportunity offers a market good enough to lure these merchants into a new field, then it certainly should be good enough for electrical men to retain, in other words, keep the electrical business in the electrical family.

The question of who is to be the logical electrical distributor is being discussed by important electrical associations quite generally. The answer is a vital one to every electrical dealer and contractor and should receive immediate and careful attention.

The manufacturer of electrical goods is asking himself the question, "How can I secure the most effective local retail distribution?" and he also asks himself, "Who is going to be the ultimate and permanent electrical merchant in your town and mine?"

Seeing the large and rapidly expanding market we urge the dealers and contractors to make regular merchants of themselves and to broaden their opportunities by grasping and holding the growing local market for electrical household appliances and electrical goods generally. The following methods have been compiled by the writer to assist the electrical dealers and contractors to keep the merchandising opportunity within the family and it is hoped that some of the suggestions made may be of use to electrical men in their endeavor to build up and hold the electrical trade.

It has been stated that electrical merchandising has been built up backwards. That is, the retail business followed the demand of the public for methods of using electrical current. Retailing has now reached enormous proportions, and electrical men, because of their practical knowledge, should be quick in adapting themselves to the selling end of the business. This practical knowledge gives the electrician such an advantage over the non-electrical distributor that he can, with a little effort and a study of store methods, establish himself as the electrical man in the community.

Store methods begin with the store windows and include the equipment of and methods used in the store to bring business. The windows are the eyes of the store. First impressions, which are often lasting, are obtained by probable customers from the treatment of windows. If the value of windows was realized, electrical merchants would, I am sure, make better use of them.

The size of floor space is not the true test of the value of the store, because if the back were turned to the front, the rental value would immediately drop. Location may have some influence on the rental value of a store, but the big determining factor is the window space. One-third of the total rent of a store is for the windows. This leads to the question of using them to the greatest possible advantage. To do this means that the windows should not be used as a storehouse. Windows should not be filled with wire and like material which are not sold to the public, nor should they be crowded so that those passing cannot see what is displayed. It does mean that the window space should be attractively decorated and contain displays which will invite the passing public into the store. This is being done in other lines and there is no reason why electrical dealers generally should not be noted for their window displays. Knowing the use of electricity, why should not the dealer use it in effective window displays? Windows should be illuminated according to proper window standards to avoid glare, and to show settings in the best manner. Electric power should be used to give motion, one of the great attracting forces. Electric fans playing ribbons against the window, electric fans and rubber baloons; a young lady using an electric washer, iron or vacuum cleaner, all are some of a hundred and one methods of energizing a window display. The window display should bolster up advertising in the local papers. If vacuum cleaners are being advertised, they should be displayed in the windows. It should be the same with irons, washers, heaters, or any other line of which a special sale is being made.

Outside the electric store there should be an electric sign. The sign need not be elaborate but it should show the location of the electric shop. If the dealer is proud of his sign and can arrange an agency for it, a circular should be sent to the different merchants in town inviting them to come and see the sign and to order signs for themselves. There are small window signs which can be used and handled to advantage. The grocer, the furniture man, the dry goods merchant, etc., are profitable customers and a good business can be worked up in signs.

In arranging goods in a store, customers should be given free entry. The door should not be blocked for any reason. Neat shelves are imperative; they cannot be storehouses for dust and old boxes. Nearest the door should be exhibited articles such as flashlights, batteries, electric bulbs, etc., which have the greatest sale. Larger goods, such as fixtures, stoves, etc., should be at the back. Customers in passing the smaller goods will often see small things they want and just a sight of an article brings the need to mind.

Selling, developing business, advertising and demonstrating are so interwoven that it is almost impossible to deal with one of these subjects without referring to the others. In fact, they may all be classed under one heading of "business getting" and the following paragraphs will deal specifically with business-getting methods.

In the first place, a true salesman speaks whenever possible in the affirmative when interesting a customer. This is clearly demonstrated in a story related to the writer after one of Toronto's numerous Tag Days. Said the one who told the story: "Coming down to the office this morning I noticed ladies selling flags for the Red Cross Fund. They were advertisers—salesmen. One said, 'You don't want a flag, do you?' I said, 'No.' Another said, 'You want a flag,' and I said 'Yes.' I couldn't escape the latter

appeal, especially as in this instance she was a very pretty girl."

It is a good thing to make sales to women. For instance, my wife bought a certain make of vacuum cleaner. She was so pleased with its operation that she had several friends in to see it, with the result that two friends, at least, have since purchased the same make. Advertise to women. Housewives purchase three-quarters of the goods used in a home. Sell a woman an electric appliance and she will advertise it. Our electric iron has sold one to four of our relatives, and I don't know who else my wife has talked into buying electrical goods. She sold one friend an electric heater because it gave good satisfaction, and if she keeps on I think it will be up to the electrical companies to pay her a commission. The lesson is one that should not be forgotten—cater to the trade of the women.

The electric range, the electric washer and the vacuum cleaner offer untold opportunity for profits. Stove and window demonstrations attract customers, and personal calls are very effective. Some dealers have found that renting vacuum cleaners, allowing the rental price to be deducted from the price of the machine, has brought many sales. A similar policy in regard to the electric range has also been effective. By co-operating with the central station and arranging for special rates, dealers and contractors have sold many ranges and opened up a market which has untold possibilities.

In connection with the sale of electric washing machines and irons, one dealer showed the value of selecting the physiological moment for driving home the lesson of their value. He had a demonstration of washing machines and advertised it in the local papers. In addition, he prepared circulars and letters to interest his prospective customers, timing the mailing of them so that each would reach the address when the recipient was in a receptive mood. Circulars and letters were mailed to reach the prospects on Monday, which was the usual "washday" in the vicinity, the delivery of this mail matter being, moreover, so timed that the housewife would receive her circular in the afternoon. When the selling arguments of the labor-saving washer were read after a hard day's work over the washtub they did not fail to receive sympathetic attention. The same idea was also taken advantage of in planning newspaper advertising during the campaign, and it was found, for example, that a washer ad in the Monday evening paper brought more results than the same copy used any other time during the week. It was demonstrated by another dealer that electric iron advertising was more effective when used during the latter part of the week.

Seasonable opportunities should be grasped. For instance, at Christmas electrical toys and decorations should be displayed; for patriotic demonstrations, colored lights. It is possible to secure the agency of a large electrical jobber who rents or sells electrical goods for patriotic concerts, festivals, demonstrations, etc., and the dealer should look into this and make the next festival a memorable one by seeing that he has a chance to figure on a display of electrical flags, signs, pennants, etc.

If there is a burglary in town, the dealer should not let it pass without a large flashlight advertisement appearing near the account of it in the local paper. Accompanying this should be a display of flashlights with a card, "Your Protection Against Burglars," dividing the flashlights into groups according to price.

Circumstances give many opportunities for special sales. For instance, when there is a long birth-notice column, a letter can be sent to the mothers, pointing out the value of an electric plate for heating milk and water, the electric bed pad, special electric lights and flashlights. The store windows can be used at the same time to point out the advantage of these articles in homes where there are children.

Seasonable advertising may be applied to electric fans when "cool comfort" should be the keynote, and to electric grates to take the chill from the room on a cool morning.

The Society for Electrical Development has been popularizing Electrical Prosperity Week and Edison Day. If these special times are celebrated annually there will be a cumulative effect of the constant driving home of the lesson of usefulness of Edison's discoveries.

Other competitive lines are being advertised and this affords another opportunity for driving home the lessons of electricity——no dirt, no smoke, no fumes. The gas association holds a gas-range week, a gas-light week, etc. If the hardware dealer and others are displaying and advertising ranges, the electrical dealer should get up an electric-range display and advertise it—no dirt, no smoke, no fumes. "Cook by wire," as one dealer puts it in his advertisement.

The dealer should make a habit of not running out of stock. A check system on your stock, so that when a fixed minimum is reached an order is placed for more, works out to best advantage. One electrical dealer who was out of an article, instead of going to another electrical store, obtained it at a hardware store from a man who is trying to capture business which does not rightfully belong to him. This is one instance where the dealer and contractor may co-operate.

In the smaller centers, the dealer and contractor is called upon to do varied classes of repair work. When a big job is brought to him he has to refuse it because of lack of equipment. This is where co-operation comes in. By making arrangements with a prominent contractor in the city he can accept the largest work and be assured that the repairs will be made with greatest care and speed. He then establishes himself in the smaller community as an out-and-out contractor.

There is an excellent opportunity for the contractor who drives home the lesson to "Wire your home". A call on a person putting up a new house or moving, and a reminder occasionally by letter or circular will help build up a good trade. When doing the work, do it to suit the person for whom you are doing the job. For instance, a certain lady wanted a light in a certain location in the basement. The workman said this (indicating about the center) is where we usually put it, and he attached it there. A future customer was thus lost.

In a fine house in Toronto the cord runs across the center of the wall to the lamp. In another the lamp was installed in the bathroom so that every time the door was opened the lamp was in danger of being smashed and a second contractor was called in to fix it. Work should be done well to get repeat orders. There is money in future business.

In planning out work required for a house the customer should not have unnecessary expense inflicted upon him. If the job is a small one, the dealer can be pleased with it and can do it efficiently, for the small order often leads to larger jobs. If complaints are made about work, they should be attended to, and acceptable explanations made. In one case I know a contractor promised to make right a defective switch and, although he was reminded repeatedly, the switch was not repaired. The customer has had other work to do and it went to another contractor.

It is only by the adoption of such up-to-date methods as those hinted at that the electrical dealer and contractor can build up and retain the electrical retailing business. These merely give a hint, but observing the methods of other dealers, reading the trade papers, and meeting in convention and local meetings, methods will be evolved which will keep the electric shop always before the people and prevent any other merchants from taking the trade away from the electrical family, where it rightfully belongs.

Electric Washers in Effective Window Display.

The Philadelphia electric shop of J. F. Buchanan & Company, 1719 Chestnut Street, is remarkable for its novel and effective window displays, for which it has received recognition in contests. A recent window display of the Thor electric washing machine is shown in the accompanying illustration. One figure, of a housewife who is doing the family washing, is represented as being a thrall to the labor of scrubbing with an old-fashioned scrubbing board, while a companion figure is comfortably accomplishing the task by the aid of a Thor electric machine.

Effective Window Display of Washers.

J. E. Neutra was the dresser of the window, which received a prize from the Associated Advertising Clubs, recently in session at Philadelphia.

The Buchanan store is in the best residential portion of the city and caters to a select trade.

Interesting Electric Washing Machine Display in Louisville.

The Tafel Electric Company, Louisville, Ky., distributors of the Eden electric washer, has been maintaining an interesting window display. Dolls are used, one sitting and reading beside a diminutive mechanical washer, while another is bobbing up and down over a washboard in a tub. A log house, built of corn stalks, illustrates an earlier period when the women washers took the clothing to the stream and washed them there.

Appliance Sales in Philadelphia Successful.

The Philadelphia Electric Company has just closed a month's campaign for the sale of electric irons. A $3.50 iron and $2 ironing board were sold in combination for $3.75. About 1,500 of each of these requisites to summer comfort were sold in the 22 business days.

During the month of May the company's Electric Shop placed 200 $85 washing machines, its special price being $70—$10 down and $5 per month.

The company's practice is to hold a special appliance campaign monthly, except during December, when the rush of Christmas sales precludes any special campaign. During July and August, however, fans have pre-eminence.

The sales department, of which Mr. Delaney is the head, seizes upon the peculiar needs of the season and conducts a systematic propaganda, not only at the company's main store, but also at the nine district stores throughout the city and suburbs.

The sale of electric motors, on the usual 30 days' commercial basis, is a phase of the company's business, which is perhaps unusual among large central stations.

New Electrical Merchandising Store Opened in Denver.

H. G. Reid has recently opened a new store at 219 Fifteenth Street, Denver, Colo., and is featuring electrical wiring and fixtures. The store, while one of the smallest of its kind in Denver, is arranged with the idea of making the small quarters serviceable and at the same time as attractive as possible.

Different fixtures offered for sale by the concern are displayed in the window, as shown in the accompanying illustration. Attention to the articles in the window is called by cards with well-worded phrases on them. The window also serves as a show case on the inside of the store, as a curtain only a foot or so high forms a background and the entire contents of the window is in full view from the inside of the store as well as the outside. Thus good can be sold from the window as handily as from a show case.

The interior of the store consists of racks on two sides of the room on which are arranged the different kinds of lighting fixtures handled by Mr. Reid. The different types of fixtures are grouped together and kept track of so at the end of the day a quick inventory of the entire stock is made possible. As the stock is sold new fixtures are brought in from the storeroom to fill the gap made by the day's sales.

The other part of the front of the store is taken up with office fixtures and there the routine business of the concern is transacted. The back part of the store, which is partitioned off from the front, is used as a storeroom.

The store is kept very clean, as it is the opinion of the proprietor that a clean place of business is an aid toward attractiveness and is a point that is sure to impress customers, and will always aid in making a sale. Not only is the store kept free from dust, but every bit of stock is cleaned each day.

The management of the firm is very optimistic of the future of the Reid store, and he has cause to be. The store is on a main street in the downtown section of the city, and while the place of business is small and at the present time not carrying what might be called a very large stock, it is a growing business and promises to become one of the leading firms of its kind in Denver.

Exterior of New Denver Store.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

A Novel Short-Circuiting Plug for Grounded-Neutral Cutouts.

The National Electrical Code specifies that automatic cut-outs (fuses) must not be placed in any permanently

Bryant Short-Circuiting Plug for Grounded-Neutral Cutout, Installed.

grounded wire, except in two-wire branches from three-wire systems in which neutral fuses are omitted or where the pressure between outside wires is over 250 volts. This means that a fuse cannot be used in the grounded wire in the entrance cutout, or in any of the intermedite three-wire cutouts.

To provide ready means for complying with this specification, the Bryant Electric Company has brought out what is known as the No. 559 short-circuiting plug, which has been approved for use under this rule when the plug is soldered to the screw shell so that the plug cannot be removed. This plug is made of a porcelain body with a copper shell threaded to fit the screw shell of the cutout. A slot in the top of the plug permits of the use of screw driver for turning the plug firmly into the screw shell. A projection on the base of the plug—similar to the contact projection on the fuse base—insures positive contact at this point. A view of the short-circuiting plug in position is shown herewith.

As will be noted in the illustration, a depression is provided in the porcelain and an adjacent hole is provided through the side of the screw shell of the plug for conveniently soldering the plug to the screw shell. These plugs can therefore be used with almost the same convenience as the ordinary fuse plug. Up to the present time, the Bryant Electric Company is the only manufacturer of electrical wiring devices who has appreciated the advantages of such a device, the list price of which amounts to only five cents.

Two Improved Forms of Electrolytic Lightning Arresters.

The Westinghouse Electric & Manufacturnig Company, East Pittsburgh, Pa., as a result of research work which has been carried on continuously for the purpose of increasing the efficiency of electrolytic lightning arresters, has made several improvements in its line of such apparatus and now offers the two forms illustrated, designated as types A and AK. The type A arrester is designed for voltages up to 2,450 and is furnished for indoor mounting only; the type AK is for operation on alternating current at 2,000 volts and above, particularly where generators are to be protected.

The electrolytic lighting arrester offers a very high resistance to the flow of current at normal voltages and very low resistance to current at abnormal voltages, the change in resistance being instantaneous with the change in voltage. It also acts as a condenser, so that its effective resistance to current at low or normal frequencies is great, but to currents at high or abnormal frequencies, such as the frequencies of static disturbances, it is small. These two properties are due to films electrochemically deposited on aluminum trays in the arrester.

While designed for direct-current service in railway or lighting power houses and substations, the present form of type A arrester with spark gap may also be used for low-voltage alternating-current installations. It is similar in construction to the type AK except that no charging resistance is required. The same aluminum trays are used, and these are mounted in an iron tank of ample strength, and of such size as to provide sufficient oil for cooling purposes under all possible operating conditions. As the size of aluminum plate exposed to the electrolyte is twice that of any other alternating-current aluminum arrester, this arrester exceeds in discharge capacity any other arrester for similar service. It is not limited to any particular kilo-

Electrolytic Lightning Arrester.

watt capacity of circuit. It is furnished with a fuse mounted on top of the tank and with a gap for insulating the arrester from the line. This gap can be easily short-circuited for charging purposes, which operation should be per-

formed once a day. The arrester can be operated on direct current with the gap closed, but in this case the leakage current disintegrates the aluminum trays and the electrolyte, giving them a much shorter life than when a gap is used.

The type AK arrester consists of a system of nested, aluminum double-cone or cup-shaped trays containing the electrolyte; these trays are supported on porcelain and secured in frames of treated wood, arranged in a steel tank. The system of trays is electrically connected between line and ground and between line and line. The distinctive features about this arrester are: A new inorganic electrolyte that is more stable chemically, less affected by heat, and which causes less dissolution of the film between charging periods than any electrolyte previously on the market; double-cone-shaped aluminum trays, the area exposed to electrolyte being double that of any other arrester; trays spaced by porcelain pieces and not touching wood; ventilating duct in center of tray stack for additional circulation of oil; tank linings of Bakelite Micarta, impervious to moisture; charge and discharge resistance and fuses included on all arresters.

The type AK arresters for outdoor service are the same as the indoor arresters, except that the outdoor arresters are provided on terminals. These outdoor arresters are not furnished for voltages of less than 10,000, as for voltages below this the horn gaps cannot with safety be set close enough together out of doors to take advantage of the freedom of discharge of the electrolytic element. If the horn gaps are set too close, they are short-circuited.

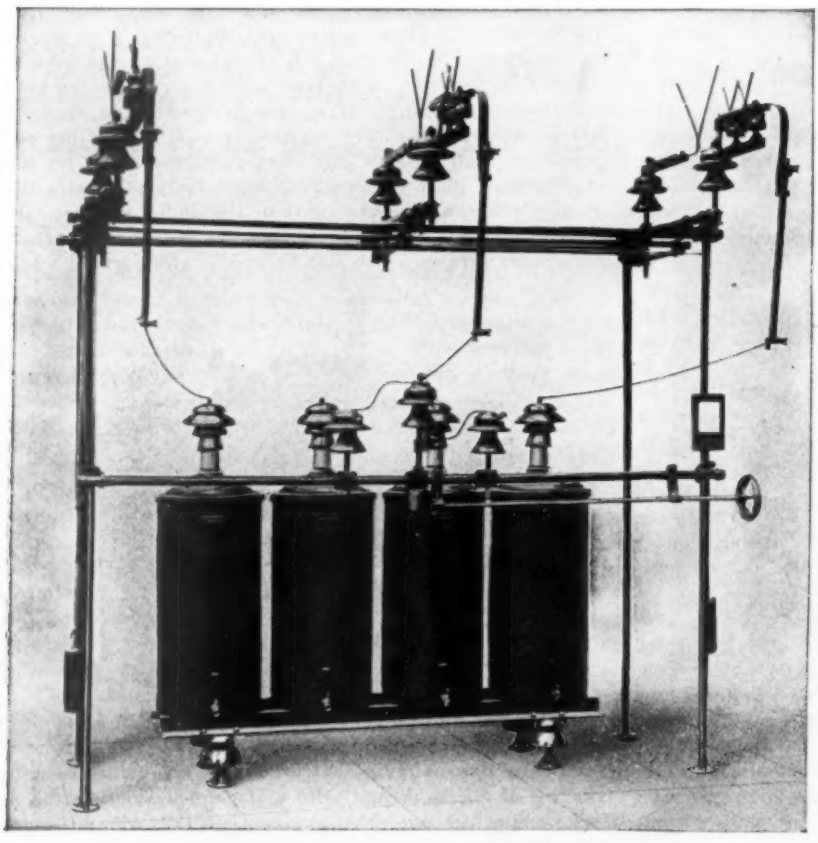
Horn gaps are furnished on all type AK arresters. They are readily adjustable for any line voltage and so arranged that the bridging necessary for charging is easily accomplished. On indoor arresters, for voltages below 9,900 volts, bridging is accomplished by tilting one horn of each pair until a phosphor-bronze strip attached to each movable horn comes in contact with the corresponding horn and short-circuits the gap. A spring insures the return of the movable horns to their normal position after charging. For charging arresters on circuits of 10,000 volts and higher, the proper adjustment of the gap is obtained by setting a stop on the horizontal bar that turns one of each pair of horns about on its own axis. When properly adjusted for operation the horns are slightly offset. When the arresters are to be charged the horns are swung back until they are in the same plane. The horns, when opened to their widest extent, serve as a disconnecting switch and insure safety to those working about the arrester.

A charge and discharge resistance connected between the main horn gap and the arrester proper is furnished with all type AK arresters. These resistance units consist of rod resistors in shunt with small spark gaps. The resistor is of a composition known as Koppat possessing the quality of remaining practically uniform under all conditions of service. The shunt gaps are between small horns. In the low-voltage arresters one resistance rod and one shunt gap are used. In the higher-voltage arresters, two of each are used in series.

Sudan Reflectors for Semi-Indirect Lighting.

Since semi-indirect lighting came into great popularity a few years ago it has been noticed that the glassware in most of the installations is of such light density as to permit the majority or at least a very large part of light generated to pass directly through the reflector. It has frequently been urged that such units should be called more appropriately modified direct-lighting units, because use of the bowl serves merely to decrease the brilliancy of the direct light. Only a minor portion of the light in this case is actually reflected from the ceiling and the advantage of approach to pure indirect lighting is therefore lost.

It has been felt for some time by manufacturers of glass-



Improved Form of Electrolytic Lightning Arrester.

Semi-Indirect Fixture Using New Sudan Glass Reflector.

ware that there was an urgent need for a much denser glass in units of this type and the Ivanhoe-Regent Works of General Electric Company, Cleveland, O., has been one of the first manufacturers to develop glassware purposely suited for this purpose. This glass is known as Sudan and the characteristic unit made of it including suspension is shown in the accompanying illustration. Large numbers of this unit have been installed for school lighting in the city of Cleveland and in other places.

The density of this glass is such that it transmits through it directly only about enough light to give the unit a brilliancy approximating that of the ceiling. The great bulk of the light is reflected against the ceiling for true indirect illumination. In other words, this glass is a very efficient reflector and what light passes through it is so well diffused as to minimize the high lights and shadows on the surface illuminated, consequently also protecting the eyes much more effectively.

This reflector is of pleasing design, making it especially suitable for use in school rooms, auditoriums, drafting rooms, offices and in other places where fairly high illumination is desired and yet careful consideration must be given to comfortable lighting as free as possible from glare and eye strain.

The unit shown is designated as No. 3031. It is made in two sizes, 11 and 14 inches in diameter. The former size is intended for use with 100-watt type C Mazda lamps and the larger size can be used with lamps ranging from 200 to 1,000 watts.

Direct lighting reflectors made of Sudan glass of equal density are also made. These serve to screen the light that passes through the reflector more completely than is common with glass reflectors of this type. A larger percentage of the light than usual is reflected down upon the illuminated plane.

New Electric Washer.

The Victor Manufacturing Company, of Leavenworth, Kans., has recently placed a new washer on the market, known as the "Wonder" washer and sold with a five-year guarantee. The tub is made of heavy cold-rolled polished copper, tinned on the inside. The legs are of steel tubing with steel braces. They are copper-plated and polished to match the finish of the tub. A stand is made for the tub which folds back out of the way when not in use.

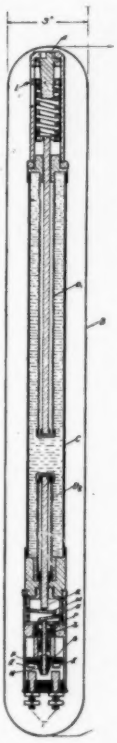
The wringer is reversible and is provided with ball bearings. The gears are fully inclosed. The operating mechanism of the washer is provided with ball bearings and so constructed that the gear is automatically disconnected when the cover of the tub is raised. The water capacity of the washer is 17 gallons, and the machine weighs 115 pounds.

New Electric Washer.

It is belt driven by a one-eighth horsepower motor, manufactured by the Robbins & Myers Company, Springfield, O. The motor is a splashproof design which is made especially for washing-machine service.

Sarco Thermo Switch.

The Sarco Company, Incorporated, Woolworth Building, New York, N. Y., maker of the Sarco temperature regulator, for steam, water and gas valves, has designed and is marketing a modification to operate an electric switch. This new apparatus combines the expansion element of the ordinary Sarco regulator with a specially designed switch, as shown in the accompanying sketch. It is intended to furnish a means of operating electrically a switch for controlling a supply of current for heating or a motor for distribution of hot air or for any other purpose requiring the control of an electric circuit by temperature changes.



Sarco Thermo Switch.

The instrument shown has a calibrated scale from 58 to 78 degrees Fahrenheit and is intended to operate the switch with a change of approximately two degrees in temperature. It can be constructed for any temperature up to 325 degrees Fahrenheit.

The operating mechanism employs a brass tube filled with a heavy hydrocarbon oil, which on expansion compresses a Sarco spiral tube inserted in the oil. This spiral tube, which is the same as that used in Sarco steam traps and temperature regulators, is capable of withstanding pressures up to 2,000 pounds, but a special safety device is furnished in the form of a heavy steel spring in the regulating head. The following is a description of the electrical switch:

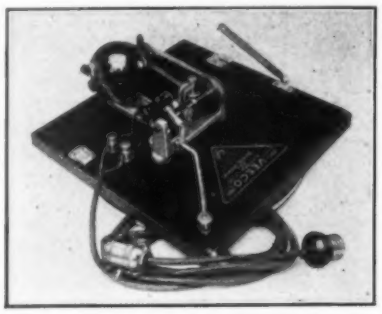
The expansion element pushes a rod out of the end of a tube by the expansion of liquid, derived from increase in temperature. The movement is multiplied by levers. A motion is obtained sufficient to operate the snap switch even with very slight changes in temperatures.

The illustration shows the instrument in the "hot" position with the plunger extended. As the instrument changes to "cold" position, the rod R is slowly withdrawn into the tube followed up by the plunger *P*, which operation is based upon the action of the spring *X*. The insulating member carrying the switch blade *F* is held in its illustrated position by the brass seat, against which it rests; therefore, the plunger head *H* is withdrawn slowly through this insulating member, expanding the spring *S*, which is an endless coil spring free to roll from one end to the other of the plunger head, carrying with it the insulating member which carries the switch contacts. As the plunger draws through this switch member, the spring *S* expands and as the point of greatest diameter of the plunger head passes through the center of the spring *S*, the compression of which causes it to travel down the plunger head, carrying with it the insulating member carrying the switch arms, which then hop over and locate themselves on the terminal posts *T*, thus closing the circuit. This condition then obtains until the process reverses itself by a temperature change.

This switch is perfectly safe to operate on a 220-volt direct-current or alternating-current circuit and it will, without doubt, carry five amperes. Its action is very quick and positive. The device will work with lamps in series without causing a flicker.

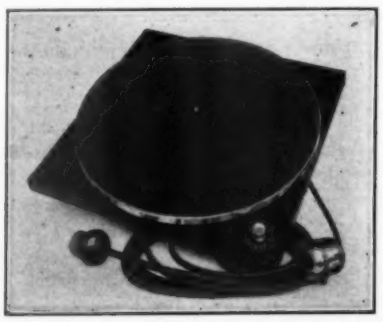
Veeco Electric Motor for Driving Phonographs.

The automatic operation of phonographs, so as to avoid the need of winding the spring after almost every record has been played, has been given a great deal of attention. Naturally electric drive of the instrument was suggested long ago, but in connection with it a number of difficulties have arisen, of which absolute quietness of running is one important feature. This matter has been given a great deal of attention by the Victor Electrical Equipment Company, 248 Boylston Street, Boston, Mass., and it is now placing on the market a compact especially designed motor, known as the Veeco.



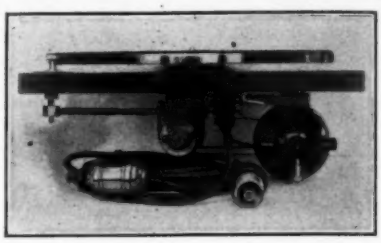
Under Side of Record Plate Showing Veeco Motor in Position.

This motor is a small and light-weight device, which can be readily attached to any phonograph. The motor is of the universal type and can be operated on either an alternating-current or direct-current circuit and is usually supplied for standard voltages so as to be easily connected to any ordinary lighting outlet of 100 to 125 volts. The motor can also be supplied for any other pressure from 6 volts to 250 volts. In applying the motor, which comes attached to the underside of a board it is necessary merely to remove the board holding the spring motor and put in place of this the board holding the electric drive. The connecting cord for the motor is run through the hole provided for the crank used in connection with winding the ordinary spring motor. The new motor has been especially developed to meet the requirements of the case and permits a change in tempo from 20 to 120 revolutions of the disk per minute.



Top of Record Plate Showing Cord for Motor.

It can be started and stopped by means of the switch connected into the cord and this switch may be placed at any desired point to suit the convenience of the user. It is said this arrangement makes it especially suitable for instruction in dancing, as the instructor can control the machine from almost any point in the room. This motor avoids all the petty annoyances connected with the use of spring motors, including not only frequent rewinding but also the likelihood of change in tempo during the rendering of a selection, if this winding is neglected, The use of this motor has been highly recommended by various electrical interests that have investigated its merits.



Side View Showing Location of Motor.

Interestng Application of Gyrating Fans in Hair-Dressing Establishment.

In the better class of hair-dressing and manicuring establishments a great deal of attention is given to the consideration of patrons' comfort. Refinement of appointments are to a large extent responsible for the success of an establishment. Ventilation is probably the greatest factor, particularly where there are a number of booths or small rooms. The air should be fresh and cool and kept in constant motion, but without a strong draught. This can best be accomplished by employing a method similar to that shown in the illustration.

The picture shows Simson's hair-dressing parlor, 506 Fifth Avenue, New York City. Here five Westinghouse gyrating fans (equivalent to ten stationary fans) are employed to ventilate ten booths and a long center aisle. Each set of double fans produces a continuous flow of air outward at any desired angle from the horizontal, and the direction of this flow is continually gyrating about the central axis. The diverging current from the fans sweeps about and causes air movements in all parts of the establishment so that at any point the air feels fresh and cool. All the air is kept in motion in all directions without causing a steady draught in any one direction. Ordinarily 15 stationary or 10 oscillating fans would be required and even these would not give the same good results. The fans, as will be noticed from the illustration, are so placed that they are a decided ornament to the place and take up no useful space whatever.

Gyrating Fans in Hair-Dressing Establishment.

Haven Soldering Lamp.

Illustrated herewith is a simple improved soldering lamp invented and patented by John N. Haven, Walla Walla, Wash., for the use of linemen and electricians generally, but more especially for linemen working on telephone wires, as there is practically no device that serves satisfactorily for this purpose. The gasoline blow torch is not suitable for this use, as nearly all telephone companies forbid its use for soldering line wires because the extreme heat produced anneals or crystallizes the wires so that they will break from the tension to which they are subjected. The soldering iron is very slow and not efficient, as it will cool before it can be taken to the top of a pole and a poorly soldered joint is the result. Ordinary open-flame lamps cannot be considered, as they will not remain lighted in a wind and, if they do, the flame will be so deflected by the wind that the wire will not become heated enough to solder.

Telephone installers, inside wiremen and electric light fixture installers will find that this new lamp will accomplish all that any lamp now in use for soldering small wires will accomplish, with the additional features that it can be used as a lamp for lighting and does not use liquid fuel, thereby reducing the fire hazard. It uses only a small heat, which is applied directly to the point desired and solders perfectly without burning or annealing the wires.

The first cost of the Haven lamp is much less than that of a blow torch and it requires no fuel supply other than a candle, which is always carried by the workman. It can be lighted with a match in very strong winds and by means of a draft regulator, will keep a sufficiently steady flame to solder a joint perfectly at all times, according to the inventor.

The Haven lamp consists of the two main parts shown in Fig. 1. The lower part shown at the right serves as a candle holder, having a tubular cylinder within which the candle height can be adjusted. The space around the holder portion catches the melted tallow. This lower part is used alone when using the outfit for lighting. The cover of the lamp, shown at the left in Fig. 1, consists of two telescoping parts, of which the lower or inner sleeve has draft holes that co-operate with the corresponding holes near the top of the base to permit regulation of draft. The cap or upper part of the cover serves chiefiy as a wind shield; it has two notches on opposite sides to receive the wire. On lifting the cap, as shown in Fig. 2, the lamp can be slipped over the wire and when the cap is dropped down the wire rests in the notches referred to, the joint to be soldered being directly over the flame. The lamp is now laid suspended on the wire and the hands of the operator are left free for the soldering. The solder stick is introduced through a hole in the top of the cap.

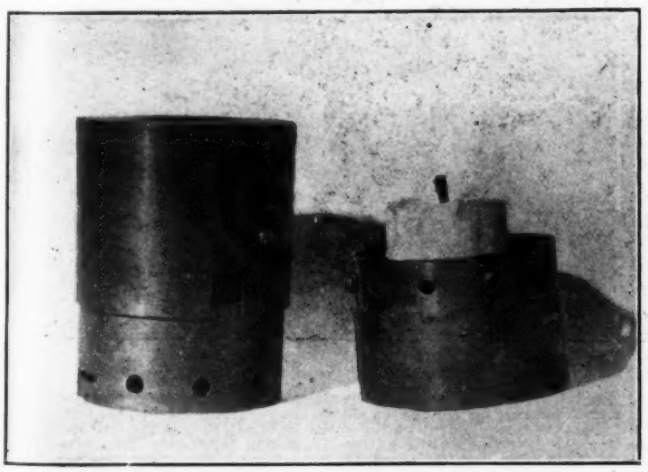


Fig. 1.—The Two Main Parts of the Haven Soldering Lamp.

Use of the Haven lamp has been found to expediate soldering of small line wires and to promote the making of better joints than can possibly be done in any other manner.

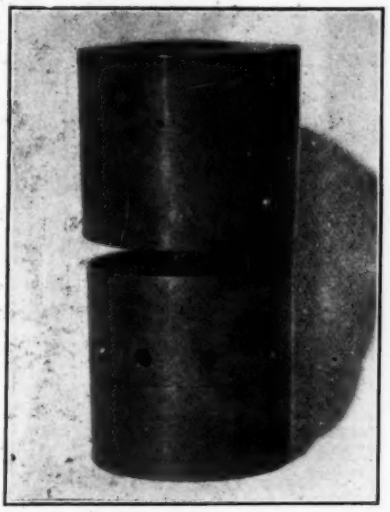
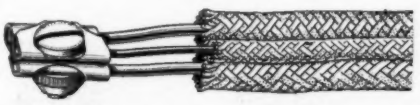


Fig. 2.—The Haven Soldering Lamp Assembled.

Midget Solderless Clamp Connector for Fixture Wiring.

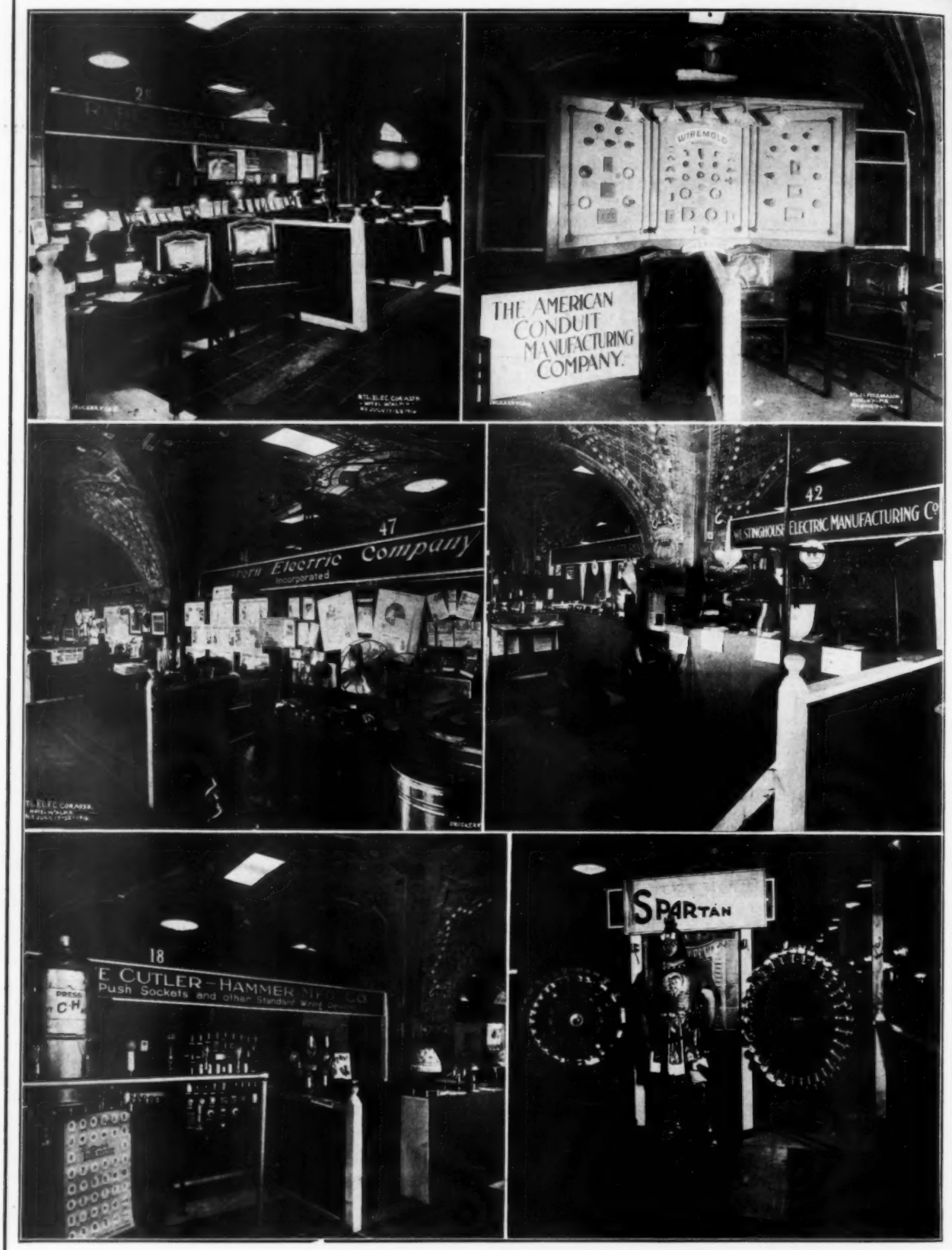
In wiring fixtures considerable difficulty is experienced in connecting the circuit wires to the wires in the fixture. As a rule the fixture canopy has but little room and it is no easy thing to make a good soldered joint, such as is required unless some approved form of solderless connector is used. A new type of this kind of connector is being placed on the market by Alexander B. Simpson, 152 East 53rd Street, New York City.



Midget Solderless Clamp Connector for Fixture Wiring.

As shown in the accompanying diagram this is a very simple form of connector, consisting of a special brass sheet folded over to form three loops and provided with a brass clamping bolt. It is unnecessary to remove the nut, but merely loosening suffices. The wires are inserted singly into the loops and then the screw securely tightened. This makes a very tight joint. When tightening up the screw the knurling of the nut effectively prevents its turning.

This form of connector makes a clean connection, avoiding entirely the mess and dirt and also danger connected with the use of torch or other soldering means. It can be used to connect three wires or two wires; in the former case each loop holds a wire, but in the second case one of the wires is folded through two of the loops. If two connectors are placed on one of the wires, the device can be used to connect as many as five wires. As soon as the connection is tight, the joint is wrapped with rubber and friction tape. The use of this connector has been approved by the New York City Department of Water Supply, Gas and Electricity.



Exhibits at National Electrical Contractors' Convention

One of the interesting features of the sixteenth annual convention of the National Electrical Contractors' Association at New York City recently, was the exhibit maintained by the manufacturers in the Terra Cotta room of the Hotel McAlpin. Every available foot of space was occupied and it is believed that a closer co-operation will exist between contractors and manufacturers because of the opportunity this exhibit afforded for "getting together." Much ingenuity was displayed by the exhibitors in arranging their booths and showing their wares to the best advantage and many expressions of praise were heard. Six of the exhibits are shown herewith.

INDUSTRY ACTIVITIES

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued Bulletin No. 1012, on local-battery switchboards.

Womble Storage Battery Manufacturing Company has located a plant at 204 Market Street, Chattanooga, Tenn., and is equipped to manufacture batteries for all purposes.

Roller-Smith Company, 233 Broadway, New York City, maker of electrical instruments and circuit-breakers, has established an agency at 1011 Franklin Bank Building, Philadelphia, Pa., Eugene F. Le Noir being in charge.

Northern White Cedar Association, Minneapolis, Minn., has issued a wall hanger giving illustrations of three northern white cedar posts which were removed after being set 40 years and which show a very good state of preservation.

James E. Gleason Company, 106 South Clinton Street, Chicago, Ill., has been appointed general selling agents for the P. & B. Manufacturing Company, 189 Fifth Street, Milwaukee, Wis., manufacturer of outlet boxes, BX connectors, fixture studs and conduit fittings.

Capital Electric Company, 321 North Sheldon Street, Chicago, Ill., has issued a 12-page folder for the trade, which describes and illustrates its line of "Geyser" electric washing machines. These machines are very simple in construction, a motor and a two-blade propeller being the only washer mechanism. They are made in three sizes, the "Baby Geyser," family, and home laundry.

King Foundry Company, St. Joseph, Mo., announces the removal on August 1 of its main sales office from St. Joseph to 927 Monadnock Block, Chicago, Ill. H. L. Dollahan is in charge of the office, M. Gustafson being assistant sales manager. Working from the main office are E. M. Hervey and Frank Hollister, special salesmen. Among the recent contracts made by the company for ornamental lamp posts are those with the city of St. Paul, Minn., 458 posts; Detroit, Mich., 400 posts; Saginaw, Mich., 376 posts and Williston, N. D., 217 posts. A marked tendency has been noted toward the installation of trolley-pole brackets in order to avoid the addition of poles on city streets. The King company has made a specialty of the design of ornamental brackets and has recently made installations at Chippewa Falls, Wis.; Peru, Ind.; Springfield, Mo.; Gladstone, Mich., and other cities.

The Locke Insulator Manufacturing Company, Victor, N. Y., manufacturer of "Victor" high-voltage porcelain insulators and electric power line specialties, has issued the first edition of "The Insulator Book." The book is designed for real service and is a handbook of matters pertaining to the insulation of electric lines, as well as a catalog of the company's products. In its treatment of the transmission line, valuable information is given regarding mechanical construction, minimum spacings, specifications for steel towers and wood poles, crossarms and wire, besides general topics. Then follows a complete listing of the company's stock products, illustrated, described and priced. There is also included a large number of tables likely to be needed by those using the book. The catalog is very attractively and very well printed on heavy stock, 9 by 6 inches, and bound in a neat cover. To any one interested in insulators and transmission lines "The Insulator Book" will be found an exceedingly valuable possession, fit in its content and presentation for any desk or library.

The Safety Armorite Conduit Company, Pittsburgh, Pa., announces that application has been made to have a receiver appointed, and, in accordance with the law, the Court of Common Pleas, of Allegheny County, Pennsylvania, has appointed Thomas L. Brown (formerly treasurer of the Westinghouse Machine Company) as temporary receiver, and directed a final hearing to be held before the court at the court house, Pittsburgh, Pa., on Friday, August 4, at 10 o'clock a. m., when the matter of a permanent receiver will be decided. The company asks the co-operation of its creditors and stockholders in its efforts to conserve the business and property. Any information desired will be cheerfully given.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has sold to the Cornelia Copper Company, for its leaching plant, three large motor-generator sets, each capable of delivering 10,000 amperes continually at 170 volts, and a completely equipped switchboard. The Cornelia Copper Company is an offspring of the Calumet and Arizona Mining Company and was formed to handle the low-grade ores from the parent company's claim near Ajo, Ariz. The company has sold the following steel-mill equipment: A 7,000-horsepower induction motor for driving a 16-inch plate mill and a 4,000-horsepower induction motor for operating a 20-inch merchant mill to the Gary Works of the Illinois Steel Company; two 1,500-horsepower, three-phase, 25-cycle, 6,600-volt, adjustable-speed, phase-wound motors to the Carnegie Steel Company for installation in its Duquesne Works. One of the motors has a speed range of from 218 to 145 revolutions per minute and is to be used for operating four roughing mills. The other has a speed range of from 360 to 240 revolutions per minute and is to be used for driving a 12-inch merchant mill.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued an eight-page booklet describing its line of electrically heated candy manufacturing appliances. The booklet includes descriptions of chocolate warmers of the rectangular and round types, side pans for use with chocolate warmers, and electric batch warmers for providing radiant heat in the manufacture of hard candies where pulling or stretching is necessary. The booklet points out several of the advantages of electric heating in candy factories. It is claimed that the cleanliness, efficiency and economy of electricity, combined with the improved quality and quantity of the product, makes electric heat not only desirable, but necessary. The company has issued an eight-page folder on Cutler-Hammer machine-tool controllers, which are described in three classes, as plain starting, speed-setting, and speed-regulating. It is pointed out that the magnetic lockout switches used for the automatic acceleration of C-H machine-tool controllers eliminate all interlocking contacts and circuits, series relays, protective resistance, etc., making an extremely simple and rugged construction. By selecting the proper controller to meet a certain condition it is stated that lower maintenance costs and fewer shutdowns are assured. "Push Button Press Control" is the title of a four-page newspaper-size broadside issued by the printing equipment department of the Cuter-Hammer Manufacturing Company. The new folder describes the Kohler system of push-button press control which is stated to be in use in 80 per cent of the printing establishments of this country.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

ATTACHMENT PLUGS, Fuseless. —R. S. Mueller, 423 High Avenue, S. E., Cleveland, O.

Non-separable attachment plug, consisting of single-piece body of porcelain or standard insulating material and Edison screw shell. Conductors soldered to screw shell and center contact. "Attacho Plug." 660 watts, 250 volts, catalog No. 3.

Listed June 30, 1916.

INCLOSED SWITCH. — General Electric Company, Schenectady, N. Y.

Three-pole motor starting switch. Overload relays are not in circuit when switch is in starting position and other circuit-breakers or fuses are necessary in motor circuit. Inclosed in metal case and designed for manual operation without opening case. Type CR-1031, 7.5 horsepower, 110, 220, 440, 550 volts.

Listed June 16, 1916.

FITTINGS FOR CONDUIT BOXES, Adapters.—Dongan Electric Manufacturing Company, 741 Franklin Street, Detroit, Mich.

Adapter for inclosing wire leads in connecting standard conduit boxes to miscellaneous utilization equipment, Types P, K, S, H, "Junior," "Trancolet."

Listed June 12, 1916.

FITTINGS FOR CONDUIT BOXES, Covers.— Central Electric Company, 320 South Fifth Avenue, Chicago, Ill.

Cast-iron cover for four-inch outlet box, with a non-rigid support for fixtures. "Ralco" R7.

Listed June 5, 1916.

GROUND CLAMPS.—H. B. Sherman Company, Battle Creek, Mich.

Ground clamps for use with three-inch conduit or less. Catalog Nos. 1-3.

Listed June 30, 1916.

HEATERS, Electric. — Michigan Stove Company, Detroit, Mich.

Electric ranges made up of different combinations of oven units and hot-plate units. Garland series 10, 20, 30. Oven unit, 2,400 watts, 110 volts. Hot-plate unit, 3,600 watts or 2,400 watts, 110 volts.

Listed June 1, 1916.

MUSICAL INSTRUMENTS, Piano. —National Piano Manufacturing Company, 21 Ottawa Avenue N. W., Grand Rapids, Mich.

Automatic piano operated pneumatically by a motor-driven bellows, contained within instrument case. A special coin-switch is connected in a 110-volt relay circuit supplied by dry battery and magneto or bell-ringing transformer to operate switch controlling 110-volt motor and light circuit. 110 volts, alternating current or direct current, 0.15 horsepower.

Listed May 16, 1916.

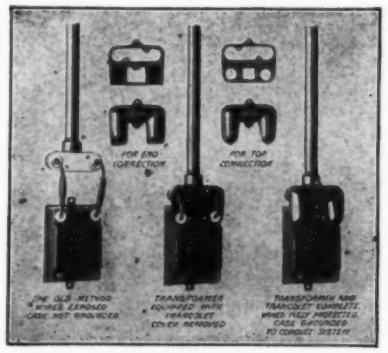
OUTLET BUSHINGS. — Adapti Manufacturing Company, 919 West Street, Cleveland, O.

Connector bushings of malleable iron or pressed steel, for connecting armored cable of flexible steel conduit to conduit boxes, catalog No. 930.

Listed June 27, 1916.

OUTLET BUSHINGS AND FITTINGS, Connectors.—Appleton Electric Company, 212 North Jefferson Street, Chicago, Ill.

Pressed steel box connector for securing outlet boxes to unthreaded



Fittings for Conduit Boxes, Adapters.— Dongan Electric Manufacturing Company.

conduit. "No-thread." Catalog Nos. 7100-01.

Listed June 28, 1916.

RECEPTACLES, For Attachment Plugs.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

Surface type, 10 amperes, 250 volts, catalog Nos. 5426-28, 5512-14, 5540-42, 5560, 5584, 5617-20, 6065-68; three-pole, catalog Nos. 6047, 6147; 20 amperes, 250 volts, catalog Nos. 5621-23; three-pole, catalog No. 6059.

Flush type, 10 amperes, 250 volts, catalog Nos. 5547, 5566, 5579, 5705-06, 6285; three-pole, catalog Nos. 6048, 6051; 20 amperes, 250 volts, catalog Nos. 5552, 5722.

Conduit box type, 10 amperes, 250 volts, catalog Nos. 5614, 5624, 5813, 6282-83.

Chandelier type, 660 watts, 250 volts, catalog Nos. 5326, 5423, 5496-97, 5733-34, 6250, 6252-53.

Angle receptacles, 660 watts, 250 volts, combining surface base with angle adapter, catalog No. 5577.

Motor attachment plugs, 10 amperes, 250 volts, catalog Nos. 5894-95, 6069, 6277.

Listed June 27, 1916.

RECEPTACLES, Standard. — Benjamin Electric Manufacturing Company, Chicago, Ill.

"Benjamin" safety receptacles. Center contacts and screw shells automatically disconnected from circuit when lamp holder is empty. Made in round form with a face-plate, or rectangular form with or without single or gang face-plates. 660 watts, 250 volts, catalog Nos. 7660, 7662, 7664, 7675.

Listed June 27, 1916.

RHEOSTATS. — Western Electric Company, New York, N. Y.

Motor-starter panels, type CR-2213-16, CR-2321-26.

Listed June 20, 1916.

SWITCHES, Automatic. — Drendell Electrical & Manufacturing Company, San Francisco, Cal.

Remote-control knife switches, arranged to be opened by closing circuit of a release coil by means of standard snap or momentary contact switches. 0-600 amperes, 125 or 250 volts, two

Listed April 14, 1916.

SWITCHES, Knife.—General Electric Company, Schenectady, N. Y.

Switch stops for G. E. Type L. Form D-12 knife switches. These devices are hinged brass blades with insulated ends and are intended to be mounted below double-throw knife switches, so that they may be thrown up and held in place by lower switch clips, preventing switch blades falling closed.

Listed June 16, 1916.

SWITCH BOXES, Covers and Supports for. — Economy Electrical Specialty Company, 6352 South Halsted Street, Chicago, Ill.

Consisting of a flat piece of steel, one end formed into a cover for mounting switches, the other having a square piece cut from support and bent at an angle of 90 degrees to act as a stop, the two straight ends of support being provided with holes for mounting.

Listed April 19, 1916.

TRANSFORMERS.—Dongan Electric Manufacturing Company, 741 Franklin Street, Detroit, Mich.

Transformers for indoor and outdoor use with "Trancolet," an adapter for inclosing lead wires and connecting to standard conduit boxes.

Listed June 12, 1916.

TRANSFORMERS.—Dongan Electric Manufacturing Company, 741 Franklin Street, Detroit, Mich.

Bell-ringing transformers, Dongan, Miller and Junior, 110 volts to 6 volts, with "Trancolet," an adapter for inclosing lead wires and connecting to standard conduit boxes.

Listed June 13, 1916.

PERSONAL AND BIOGRAPHICAL

MR. E. M. ANDERSON, the newly elected president of the Tri-State Water and Light Association of the Carolinas and Georgia, is superintendent of the municipal electric-lighting and water plants at Abbeville, S. C. During his career Mr. Anderson has had a wide experience in the electric-lighting industry. He was born in 1866 and spent his early years in Sumter, S. C. From 1886 to 1889 he was employed by the electric-lighting company in Charleston, S. C., following which he entered the erection and construction department of the Westinghouse Electric & Manufacturing Company. In 1891 he became superintendent of the Spartanburg Gas & Electric Light Company and Aetna Light Company, of Spartanburg, S. C., retaining that position until 1898, when

E. M. Anderson.

he became superintendent of the municipal electric-lighting and water plants in Union, S. C. Mr. Anderson accepted his present position in Abbeville in 1909, and since that time has accomplished a great deal in the way of improving the plants in that city, which now has more ornamental standards and a larger area of underground distribution than any city of its size in the South.

MR. C. B. WOTICKY has been appointed electrical engineer for the Lehigh Valley Railroad, with offices at South Bethlehem, Pa. MR. D. J. CARTWRIGHT recently received the appointment of assistant electrical engineer for the same railroad.

MR. W. R. EMERSON, treasurer of the Muskogee (Okla.) Gas & Electric Company, read a paper entitled "Promotion and Organization of Public Service Corporations," before the Muskogee Technical Society recently. The paper considered the hazards of the public utility business very fully and went into detail concerning promotion work and the justice of issuing promotor's stock. Costs of construction of electric light and power plants and gas plants and street railway properties were also given and proved very interesting.

MR. H. H. NEWMAN, district agent of the Public Service Corporation, of Newark, N. J., tendered an interesting address on "Serving the Public" before the Round Table Club, Trenton, N. J., July 24.

MR. BAYARD W. MENDENHALL, of the Bayard W. Mendenhall Company, Salt Lake City, Utah, manufacturer of electrical specialties, was recently elected county chairman by the Democratic party in his section.

MR. F. A. ROBERTSON has resigned from the engineering sales staff of the Canada Cement Company, Limited, to accept a position with the Hydro-electric Power Commission of Ontario.

MR. J. L. WHITE has recently been appointed district manager of the Oregon Power Company's properties in the Willamette Valley, with headquarters at Albany, Ore. Mr. White replaces MR. ATTILLA NORMAN, formerly located in Eugene, Ore.

MR. E. F. KRAMER has been elected president of the Oregon (Wis.) Electric Company, which is erecting a power plant in that city. MR. WALTER ANDERSON was appointed superintendent of construction and will be superintendent of the plant when it is placed in operation.

MR. STANLEY L. EISENHOFER, assistant engineer on the Hydro-electric System, Hamilton, Ont., has received an appointment with the Hydro-electric Power Commission of Ontario and has taken up his new duties in the new Hydro building on University Avenue, Toronto.

MR. W. J. HISS, general manager of the Southwestern Telegraph & Telephone Company, with offices in St. Louis, Mo., has been transferred to New York City, where he will serve on the personal staff of the Senior Vice-President U. N. Bethel, of the American Telegraph & Telephone Company. The promotion will become effective as soon as his successor has been appointed. Mr. Hiss has been with the Bell Telephone System for more than 20 years. Before going to St. Louis he was general manager of the Western New York division of the Bell System, with headquarters in Buffalo.

DR. A. N. TALBOT, professor of municipal and sanitary engineering, in charge of theoretical and applied mechanics at the University of Illinois, who last year was honored by the University of Pennsylvania with the degree of doctor of science, has this year been made the recipient of the degree of doctor of engineering by the University of Michigan. The circumstances attending the bestowal of this honor by the University of Michigan are unusually complimentary to Dr. Talbot. It is stated that the university has but rarely conferred the doctorate in engineering and never before upon one who is not an alumnus of the institution.

MR. W. J. O'BRIEN, who was elected president of the Arkansas Association of Public Utility Operators at the annual convention in June, is manager of the Helena Gas & Electric Company. Mr. O'Brien is a native of Helena and received his early education there, after which he entered Purdue University, graduating from the school of mechanical engineering in 1905. Following his graduation he joined the engineering department of the Denver (Colo.) Gas & Electric Company. From Denver he was transferred to Pueblo, becoming general superintendent of the Pueblo Gas & Fuel Company. Later he was called back to his home city to assume charge of the gas and electric properties there, and when the Helena Gas Company was sold and reorganized as the Helena

W. J. O'Brien.

Gas & Electric Company in 1911 he was retained as manager. Mr. O'Brien has done much toward building up his company's business. He is a believer in the policy of giving the customer the very best service possible at a reasonable price, which, coupled with unfailing courtesy to all, has resulted in substantial business increases. He is a member of the Business Men's League of Helena and has been creditably active in the public affairs of his city.

MR. LEANDER DORSEY has severed his connection as superintendent of the Whiting-Turner Construction Company to become manager of the contracting department of the Cram Engineering Company, of Baltimore, Md.

MR. B. O. AUSTIN has opened engineering offices in the Commercial Bank Building, Charlotte, N. C., where he will give attention to engineering problems concerning power plants, water systems, electric railways, illumination, industrial applications of motors, and similar work. Mr. Austin is a native of Charlotte and a graduate of North Carolina A. and M. College. Since his graduation he has been employed in the engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

PORTSMOUTH, N. H.—The New Hampshire Electric Railway Corporation has purchased the Newmarket Electric Light & Power Company and Frank A. Belden, superintendent of the Rockingham Light & Power Company of this city, will assume charge of the Newmarket plant in connection with his duties here. The New Hampshire Electric Railways Corporation is the holding company of the Rockingham Light & Power Company, the Granite State Lands Company, the Dover, Somersworth & Rochester Street Railway and the Massachusetts Northeastern Railway Company.

MERRIMAC, MASS.—It is reported that the Massachusetts Northeastern Railway, of Haverhill, contemplates the construction of a new boiler house at its power plant here.

SPRINGFIELD, MASS.—A bond issue of $45,000 has been sold, the proceeds to be used for the installation of incandescent lamps to replace the present arc lamps. Part of the proceeds will be set aside to make changes in the general equipment of the electric-lighting plant.

PAWTUCKET, R. I.—The Rhode Island Power Transmission Company has obtained easements in Warwick, West Warwick and Coventry for a pole line on which it will extend power lines from Cowesett to the village of Hope. The line in Warwick and West Warwick will be built with the permission of the Narragansett Electric Lighting Company which has an exclusive franchise in those two towns.

ALBANY, N. Y.—The North Pearl Street Business Men's Association has completed arrangements for lighting North Pearl Street. A large number of outline lamps will be placed on the store buildings. The installation will cost about $3,000.

CAPE MAY, N. J.—The power plant of the Cape May, Delaware Bay & Sewell's Point Railroad Company, the Ocean Street Passenger Railway Company and the Washington Street Railway Company, owned and operated by Nelson Z. Graves, of Philadelphia, was practically destroyed by fire recently. The plant was valued at $100,000. Energy for the operation of the trolley roads will be secured temporarily from the Cape May Light & Power Company, of which F. G. Jones is manager.

FREEHOLD, N. J.—The Board of Public Utility Commissioners has granted the Monmouth Lighting Company permission to issue bonds for $26,500 for improvements and extensions.

PRINCETON, N. J.—The Rockefeller Institute, for experimenting on animals with a view of discovering causes for human ailments, is being constructed near here and will be equipped with a private electric light and power plant. Motors for pumping water, etc., will be installed.

TRENTON, N. J.—The City Commission has approved final plans, prepared by the Public Service Electric Company, for the installation of a new street-lighting system in the business district. The system will consist of 306 lamps, each of 600-candlepower rating, mounted on ornamental poles 12 feet high and spaced 50 feet apart.

CHESTER, PA.—The Chester Paper Company will erect a new power plant in connection with extensive improvements contemplated.

HARRISBURG, PA.—A charter has been granted to the Eclipse Light, Heat & Power Company to operate in Sugar Creek Township, Venango County. The incorporators are J. E. Zimmerman, R. C. Shields and B. Marx, all of Philadelphia.

LEBANON, PA.—The Weimer Light & Power Company, of Lebanon, has been formed from the South Londonderry Cornwall, West Cornwall, Rexmont, South Annville and Mt. Gretna Light & Power Companies, with a capital of $35,000. P. L. Weimer is president of the new company.

MAUCH CHUNK, PA.—The Carbon Transit Company is installing a 375-horsepower boiler, a 300-kilowatt Westinghouse generator direct-connected to a Russell four-valve engine and a 300-kilowatt Allis-Chalmers generator direct-connected to an Erie cross-compound engine with condenser equipment.

MYERSTOWN, PA.—The Mt. Aetna Electric Company has been chartered to operate in Tulpehocken Township, Berks County, and the Marion Electric Company has been chartered to operate in Marion Township, Berks County. The incorporators are W. J. Martin, D. S. Martin and Adam Allbright, of Myerstown.

NEW HOLLAND, PA.—S. R. Rothermel, of Reading and W. J. and D. S. Martin, of Myerstown, have formed the Bowmanville Electric Company to operate in Brecknock Township, Lancaster County. Offices will be maintained in this city.

PHILADELPHIA, PA.—The Caledonia Woolen Mills will build a new boiler house and engine room at its plant at Clifton Heights.

PHILADELPHIA, PA.—The Philadelphia Electric Company will build a new nine-story building on Tenth Street, to cost about $375,000. John T. Windrim is the architect.

SPRUCE GROVE, PA.—James Ferguson, of Oxford, will install an electric-lighting plant here.

BALTIMORE, MD.—The Consolidated Gas & Electric Company will enlarge its substation at Monument and Constitution Streets, at a cost of $12,500. Switching contracts for which have been placed, will be installed in the addition.

DENTON, MD.—The Public Service Commission has received an application for the acquisition of the capital stock of $75,000 of the Peninsula Light & Power Company plant at Denton by the Eastern Shore Gas & Electric Company, of Salisbury, Md. The latter company now controls the electric plants at Cambridge, Easton, Salisbury and Federalsburg, Md., and Laurel and Delmar, Del.

SALEM, VA.—An ordinance proposing to grant a franchise for the conduct of an electric power business in the town of Salem and inviting bids thereto has been adopted by the Town Council. Bids will be received August 18.

MARTINSBURG, W. VA.—The property of the Martinsburg Power Company, consisting chiefly of power plants at dam No. 4 and dam No. 5 on the Potomac River and a plant in Martinsburg, was sold at bankruptcy sale to Emory T. Coblentz, of Hagerstown, Md., who represents interests identified with the power company and known as the reorganization committee. The price was $575,000. For some time past the interests controlling the company have been working on plans for reorganization and the plants will now be put in operation.

WELCH, W. VA.—The Tug River Electric Company has been incorporated with a capital of $700,000 by Claude Boughner, G. R. Sledge and G. C. Mace, of Gary; C. V. Updyke, of Welch, and others, to operate an electric plant for generating energy for light, heat and power at Spriggs, in Mingo County.

CAVE SPRING, GA.—At a meeting of the citizens of Cave Spring the matter of bringing an extension of the Georgia Railway Power Company's transmission line from Cedartown to Cave Spring was considered with a view of securing electric lights and power for local industries.

SAVANNAH, GA.—The City Council has passed a resolution directing the appointment of a committee to investigate the advisability of establishing a municipal electric and gas plant in connection with extensive improvements in the waterworks to be undertaken in the near future.

ST. PETERSBURG, FLA.—The Citizens Ice & Cold Storage Company will replace its steam power plant with an isolated electric plant.

NORTH CENTRAL STATES.

CLEVELAND, O.—Authority has been granted to the Northern Ohio Traction & Light Company to issue $14,075,000 of bonds, of which $12,000,000 will be used to retire present underlying securities and the remainder will be expended for extensions and improvements. H. A. Everett is president of the company.

FREMONT, O.—The Ohio State Power Company sustained a $15,000 loss last week when some of the electrical equipment at the local power plant burned out.

TIFFIN, O.—The Ohio Light & Power Company is erecting a transmission line between Fostoria, Fremont and Tiffin. The line will be used to supply electrical energy to farmers in this district.

VAN WERT, O.—The City Council is completing the necessary arrangements to remove the electric arches used to illuminate the business district and substitute the post system.

DANVILLE, IND.—The holdings of the Danville Light, Heat & Power Compnay have been purchased by the American Public Utilities Company, of Grand Rapids, Mich. M. K. Foxworthy has been retained as superintendent of the plant. The new management contemplates making extensive improvements in the distribution system in order to give more efficient service to the patrons. It is expected that the company will develop a considerable increase in its light and power service and that some extensions of transmission lines will be made.

LAPORTE, IND.—The contract to draw up plans for a new electric light and power plant which will be built in this city has been awarded to Fred Ahlgrim.

LIBERTY, IND.—Business men here are planning improvements to the electric-lighting system. J. A. Burch is interested.

RICHMOND, IND.—Work of laying cable for the new ornamental street-lighting system in the central business district has been started. There will be 117 standards erected.

ALTON, ILL.—The boiler house of the old power plant of the Alton Gas & Electric Company at Sixth and Piasa Streets was destroyed by fire recently.

EAST ST. LOUIS, ILL.—The Board of Education awarded the contract for installing two electric generators, two engines and one switchboard to S. P. Schnauer Company, for $7,712.

GENESEO, ILL.—The question of issuing bonds for the establishment of electric lighting and gas plants will be submitted to vote on August 23.

ONEIDA, ILL.—The city is planning to install a cluster lighting system in the business district.

STILLMAN VALLEY, ILL.—The Stillman Valley Electric Company has been incorporated with a capital of $8,000 by Fred M. Trumbull, J. E. Trumbull and others. A power plant will be erected as soon as a franchise is secured and equipment can be purchased.

GREENVILLE, MICH. — A boulevard lighting system will be installed here. The equipment has been purchased and work on the installation has been started.

LANSING, MICH.—The Michigan State Fair Association will install an electric-lighting system. G. W. Dickenson, of Pontiac, Mich., is general manager of the association.

BARABOO, WIS.—The holdings of the Baraboo Gas & Electric Company have been purchased by the Wisconsin Power, Light & Heat Company, of Milwaukee.

MERRILL, WIS.—The Wisconsin Valley Electric Company is changing its distribution system in this city from direct to alternating current and is installing generating equipment in the old power plant of the Lindauer Pulp & Paper Company. The new plant will have a capacity of about 1,200 horsepower.

MILWAUKEE, WIS. — The Wisconsin Railroad Commission has issued a permit to the Wisconsin Telephone Company to issue $988,000 in stock, the proceeds to pay for new construction work which will include extensions and improvements to its lines.

LANSING, IOWA.—An effort is being made to install boulevard lights along the

entire length of the main street of this city. Two sample lights are being installed and will be in operation in a few days. The cost of their installation and maintenance will be met by public subscription.

TABOR, IOWA.—The Malvern (Iowa) Light & Power Company, H. F. Boehmer, manager, is planning to reconstruct its transmission line between Malvern and this city.

WASHINGTON, IOWA.—The Iowa Gas & Electric Company, of this city, will erect 35 miles of transmission lines and five substations, material for which has been ordered. Additional generating equipment will be purchased.

WEST BRANCH, IOWA.—The Wapsie Power & Light Company, Mount Vernon, Iowa, contemplates the erection of a transmission line between Mount Vernon and this city, a distance of 17 miles, to furnish electric service here.

URICH, MO.—Plans are being made for rebuilding the local electric-lighting plant, recently destroyed by fire.

DIGHTON, KANS.—Everett & Burt, of Hutchinson, have the contract for the erection of the new water and electric-lighting plant, to be erected at a cost of $28,000.

DWIGHT, KANS.—The Harveyville Electric Light Company and the Dwight Electric Light Company have been incorporated, each with a capital of $12,000. These two companies were organized by the R. B. Fegan Company and operate electric-lighting plants in Harveyville and this city.

GEUDA SPRINGS, KANS.—Bonds in the sum of $17,000 have been voted for the establishment of an electric-lighting plant here.

NORWICH, KANS.—W. B. Rollins & Company, of Kansas City, Mo., consulting engineers, are preparing plans for a municipal electric-lighting plant here, estimated to cost $12,500.

BLUE HILL, NEB.—The City Council has let the contract for the construction of a building for the light and power plant to a Grand Island contracting firm.

BURCHARD, NEB.—The Village Board is making plans for the installation of an electric-lighting system.

BRUCE, S. D.—Plans are being made here for the purchase of the local electric-lighting system by the city.

ESMOND, N. D.—Messrs. Page & Holbrook, of Rugby, will establish an electric-lighting plant here.

PEMBINA, N. D. — Work has been started on the construction of a new electric-lighting plant here.

WAHPETON, N. D. — The Ottertail Power Company, of Fergus Falls, Minn., has begun the erection of a new power plant in this city.

SOUTH CENTRAL STATES.

NEON, KY.—The business men of this community are taking initial steps toward the organization of a light and power company.

CHATTANOOGA, TENN.—One of the two 6,500-kilowatt generators being installed by the Tennessee Power Company in its new steam plant at Parksville has been placed in service. The boiler installation has been completed and the second generator will be ready for operation soon. The new station, when completed, will give the company an available capacity of 95,000 horsepower, and when the new hydroelectric plant at Caney Creek is placed in service in the fall this figure will be raised to 110,000 horsepower.

MEMPHIS, TENN.—The Kelsey Wheel Company will enlarge its power plant and will install a 500-kilowatt generator.

BIRMINGHAM, ALA.—With the completion of the steam plant of the Alabama Power Company on the Warrior River, that company now has five transmission lines supplying the city of Birmingham. Two additional lines have been recently constructed, one running direct to the city from the new plant and the other being constructed north to Leeds. There are three lines from the hydroelectric development on the Coosa River and the emergency station at Anniston. All five lines are run into the station at Magella, where the voltage is reduced from 100,000 to 13,000 for the lines of the Birmingham Railway, Light & Power Company.

FAIRHOPE, ALA.—City officials are contemplating the erection of an electric-lighting plant.

OPELIKA, ALA.—The Alabama Power Company has arranged to supply electrical energy to this city, according to an announcement made by W. N. Walmsley, general manager of the company. Transmission lines will be erected from Alexander City to Opelika.

WEDOWEE, ALA.—The installation of a new engine in the local electric-lighting plant is contemplated by W. M. Dobson, manager.

CALHOUN CITY, MISS.—Plans are being made by city officials for the establishment of an electric-lighting plant.

BRINKLEY, ARK.—The holdings of the Brinkley Water & Light Company have been purchased by the Commonwealth Utilities Company, of St. Louis, Mo.

LITTLE ROCK, ARK.—Little Rock College will install a power plant. Frank M. Blaisdell, Bankers' Trust Building, is receiving estimates.

CROWLEY, LA.—The Board of Aldermen has approved the sale of bonds in the sum of $40,000, the proceeds to be used for erection of an electric-lighting and water plant.

CALVIN, OKLA.—Williams & Mann, of Adamson, Okla., have applied to the City Council for a franchise to erect and operate an electric-lighting plant here.

AUSTIN, TEX.—The local plant of the Southwestern Telephone Company, valued at $100,000, is a complete wreck as the result of fire. The plant will be rebuilt.

DALLAS, TEX.—The electric power line which is being erected from Mertens to Irene and Malone will soon be ready for operation and power will be furnished to a number of cotton gins in the latter towns.

HOUSTON, TEX.—Grading has commenced on the Houston, Gonzales & San Antonio Interurban Railway Company's interurban electric line that is to run between Houston and San Antonio, 192 miles.

DATES AHEAD.

Electrical Contractors' Association of Wisconsin. Convention cruise, starting at Waupaca, August 9, and ending at Oshkosh, August 12. Secretary, Albert Petermann, 626 Lloyd Street, Milwaukee, Wis.

International Association of Municipal Electricians. Annual convention, Baltimore, Md., August 22-25. Secretary, C. R. George, Houston, Tex.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 4-7. Secretary, George C. Holberton, San Francisco, Cal.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa. September 5-8. Secretary, H. N. Muller, Duquesne Light Company, Pittsburgh, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Seattle, Wash., September 5-8. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York City.

Northwest Electric Light and Power Association. Annual convention, Hotel Washington, Seattle, Wash., September 6-9. Secretary, W. G. Letson, Jim Creek Water, Light & Power Company, Arlington, Wash.

Indiana Electric Light Association. Annual convention, Anthony Hotel, Fort Wayne, Ind., September 12-14. Secretary, Thomas Donohue, Lafayette, Ind.

Illuminating Engineering Society. Annual convention, Philadelphia, Pa., September 18-21. Assistant secretary, C. D. Fawcett, 29 West Thirty-ninth Street, New York City.

Association of Iron and Steel Electrical Engineers. Annual convention, Chicago, Ill., September 18-22. Secretary, W. O. Oschmann, Oliver Steel & Foundry Company, Pittsburgh, Pa.

American Electrochemical Society. Semi-annual meeting, New York City, September 28-30. Secretary, J. W. Richards, South Bethlehem, Pa.

Electrical Supply Jobbers Association. Quarterly meeting, Hotel Statler, Cleveland, O., October 10-12. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

New England Section, N. E. L. A. Annual convention, Pittsfield, Mass., October 17-20. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 19-20. Secretary, R. H. Starrett, 15 Day Street, New York City.

Jovian Order. Annual convention, Indianapolis, Ind., October 18-20. Secretary, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

WESTERN STATES.

CARTER, MONT.—It is reported that a lighting system to supply residences and business houses in the city will be installed by the Montana Power Company at an early date.

HINSDALE, MONT.—The Board of Commissioners of Valley County has adopted plans and specifications furnished by H. H. Alvis, consulting engineer, of Great Falls, for the installation of the improvements in Hinsdale special water and electric light district. Bids will be received August 9.

PUEBLO, COLO.—Contractors have just finished wiring the new office building of the Arkansas Valley Light & Power Company at Main and Union Streets. Over 600 sockets have been placed on the exterior of the building, which gives facilities for making it the best lighted building in Pueblo.

DEMING, N. M.—The Mountain States Telephone Company is preparing to construct a new toll line from El Paso to Lordsburg, and later to extend it to Benson, Ariz. The line will be approximately 160 miles in length and will represent an expenditure of about $180,000.

SANTA FE, N. M.—The company which proposes to develop power in White Rock Canyon and furnish electric current to the towns of Albuquerque, Santa Fe and Las Vegas has increased its capital from $1,000,000 to $3,000,000. Final plans for the dam and power plant have been filed with the state engineer and must be approved before the company can proceed. The initial cost of the project is estimated at $1,933,615.

DOUGLAS, ARIZ.—The Douglas Traction & Ice Company will build a new ice and cold storage plant here at a cost of $100,000. The ice plant will be of 100 tons daily capacity.

KINGMAN, ARIZ.—The Allis-Chalmers Company has been awarded a contract by the Desert Power & Water Company for the installation of new machinery in its plant to cost about $100,000.

OATMAN, ARIZ.—The Burrows Creek Hydro Electric Power Company contemplates the installation of a large power project.

SALT LAKE CITY, UTAH.—Engineers of the Denver & Rio Grande have made estimates of the cost of the electrification of the Utah lines of the Denver & Rio Grande, including the branches to Eureka, Park City and Bingham, and it is possible that such estimates may include other branches in the state. Traffic officials of the company have declared that not only the main line but the branches going into the various canyons of the state where heavy grades are met would be electrified as soon as the financial condition of the road warranted it. H. U. Mudge, president of the Denver & Rio Grande, is in favor of the electrification of the heavy grades of the road, such as Soldier Summit, in order that faster time may be made with freight trains. The building of the high-tension line from Provo to Price and the purchase of a number of power sites on the Huntington and other rivers in the south central part of the state by the Utah Power & Light Company is regarded by those familiar with the plans of the Denver & Rio Grande as the first step in the furnishing of power to the railroad for electrification purposes.

BOISE, IDAHO.—The City Council has passed a resolution providing for the lighting of the streets of the city at a cost of about $3,475.

BOISE, IDAHO.—The Southern Idaho Water Power Company has applied to the Public Utilities Commission for permission to extend its line to Rockland.

MERIDIAN, IDAHO.—A recent fire completely destroyed the transformer house of the Post Camp of the U. S. Reclamation Service near this city, the fire originating in a barrel of oil connected to one of the transformers.

CHEHALIS, WASH.—The Valley Development Company, of Portland, Ore., has announced its intention of developing the Packwood Lake power project in the eastern and southern portion of Lewis County, Wash., by the construction of a modern power plant, where it is claimed 100,000 horsepower can be developed at a minimum expense. There has recently been filed with the county auditor of Lewis County a list of 18 water-right locations. The Valley Development Company began making surveys and investigations in this district more than 11 years ago.

DEMING, WASH.—Plans have been announced by the Puget Sound Traction, Light & Power Company for the installation of a 150-horsepower substation here to supply energy for street lighting and private consumption. The station will have an ultimate capacity of 450 horsepower.

HILLYARD, WASH.—The transformer house at the local pumping station, owned by the Washington Water Power Company, of Spokane, will be replaced with a brick fireproof building, following the request of the City Council.

NORTH YAKIMA, WASH.—A number of extensions and changes are to be made to the electric transmission service of the Pacific Power & Light Company in the vicinity of North Yakima. The service will be extended across the Yakima River into the Buena district from Wapato, this extension to include the Orcharddale and Springdale districts. The service in Wapato is to be changed by abolishing the substation and placing switches upon poles instead, thus making it possible to operate the Wapato end direct from Toppenish. The City Council of Wapato will consider a proposition from the company to supply better lighting facilities to the city at very slight additional cost.

PE ELL, WASH.—The City Council has received a petition asking that street-lighting service be restored, and to this end the Council has requested that the Central Light & Manufacturing Company submit a proposal to furnish service.

SEATTLE, WASH.—The report that the Hebb power site on the White River had been offered to the Seattle City Council at a reduction from $1,000,000 to $250,000 has been denied by P. H. Hebb, of Tacoma, who states that no reduction whatever from the original price has been made. J. D. Ross, superintendent of lighting, who authorized the statement, says that his information came from members of the City Council. This site is one of the several under consideration by the Council as an adjunct to the present municipal plant.

SPOKANE, WASH.—According to Engineer Tannatt of the Admiral Mining Company, of Spokane, a power plant will be erected by the company on Deer Creek, at a cost of $5,000.

SPOKANE, WASH.—Plans and specifications for the new Main Avenue lighting system have been approved by the City Council, and bids for materials and installation will be called for in the near future. The system will extend from Bernard Street to Madison Street.

WALLA WALLA, WASH.—The Cascade Electric & Power Company has been awarded the contract for electric fixtures for the court house at $4,000.

BAKER, ORE.—A fund of $1,000 has been raised in the city to apply on the cost of installing an ornamental street-lighting system. The Council now has under consideration several types of lamps.

MYRTLE CREEK, ORE.—At a special election to be held August 26, the City Council will submit to the voters a proposition to issue $27,000 in bonds for construction of a municipal electric light system to supply Myrtle Creek. M. B. Germond, engineer, has prepared plans for the proposed plant, which the Council has approved.

AUBURN, CAL.—The Placer County Land Company has granted the Pacific Gas & Electric Company a right-of-way across its property.

LOS ANGELES, CAL.—The Board of Public Service Commissioners is taking bids for miscellaneous electrical equipment.

LOS ANGELES, CAL.—The Board of Supervisors have approved a contract for improvement work in the Graham Lighting District.

LOS ANGELES, CAL.—The City Engineer has been requested to prepare plans for improvement work in Bonita Meadows lighting district.

SAN FRANCISCO, CAL.—Work is to be rushed in the construction of the Hetch-Hetchy project. A vast amount of power will be required for the operation of machinery at the various construction plants, which will be running by the first of the coming year. It is proposed to develop the necessary power at a temporary power plant on the Tuolumne River, near the early intake site.

SANTA PAULA, CAL.—The street-lighting committee of the Chamber of Commerce has recommended the use of marbelite posts.

VISALIA, CAL.—The Visalia Electric Railway Company has applied to the State Railroad Commission for permission to extend its line to different points in Tulare County. The construction will consist of approximately 46 miles of trackage. The new line will extend from Exeter, thence to Lindsay, Strathmore, Porterville, Terra Bella and Ducor, and a two-mile extension from Strathmore to El Mirador.

WOODLAND, CAL.—The Northern California Power Company has been granted a franchise over certain public highways in Yolo County.

Proposals

ELECTRIC CRANES.—Bids will be received until September 13 by the Sewerage and Water Board, New Orleans, La., for two 15-ton electric traveling cranes.

LIGHTING SYSTEM.—Bids will be received by the Board of Commissioners, Huntington, W. Va., until August 7 for furnishing all material and doing all work necessary to install a Monolite lighting system on several streets. O. H. Wells, Commissioner of Streets.

PORTABLE DESK LAMPS.—Sealed proposals will be opened in the office of the Supervising Architect, Treasury Department, Washington, D. C., at 3 p. m., August 28, 1916, for supplying to the various federal buildings, marine hospitals and quarantine stations under the control of the Treasury Department, portable desk lamps during the fiscal year ending June 30, 1917, in accordance with the drawing and specifications, copies of which may be had at that office in the discretion of the Supervising Architect.

CABLE.—Sealed proposals will be received by the Commission of Gas and Electricity, 614 City Hall, Chicago, Ill., until August 8 for furnishing alarm and police telegraph cable in accordance with specifications on file in said commissioner's office and in the following approximate amounts: No. 16 B. & S. gauge, rubber-covered and lead-covered cable, 5,600 feet of two-conductor and 18,000 feet of four-conductor, No. 19 B. & S. gauge, paper-covered and lead-covered cable, 10,560 feet of five-pair, 10,560 feet of 10-pair and 10,560 feet of 15-pair.

ELECTRICAL CONSTRUCTION.—Sealed bids will be received until August 12 by the Town Council of Front Royal, Va., for the following work in connection with additions to the municipal electric-lighting plant: Enlargement of forebay and tailrace and construction of new power house; turbine equipment; additions to present switchboard and other electrical work. Bids may be submitted on the work complete or on separate items. Plans and specifications may be obtained from E. V. Dunstan, consulting engineer, 3420 Thirty-sixth Street, Washington, D. C., upon deposit of $10. W. W. Sonner, chairman of the electric light committee.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 9943, Norfolk, Va., 205 vibrating, W. T. bells and buzzers. Schedule 9946, Norfolk, Va., 10,000 arc-lamp carbons, 0.5 by 12-inch; Brooklyn, N. Y., 65 12 and 16-inch, 110-volt, alternating-current fans. Schedule 952, Brooklyn, N. Y., 90,000 feet of telephone cord. Schedule 9965, Brooklyn, N. Y., 49,000 feet of rubber-covered wire. Schedule 9966, Brooklyn, N. Y., 270,000 feet of double conductor, 600,000 feet of bell wire, 335,000 feet of double-conductor wire and miscellaneous single and twin-conductor wire. Bidders desiring to submit proposals should make application immediately for schedules to the Bureau, or to the Purchasing Office nearest to navy yard where delivery is to be made.

Financial Notes

The Montana Power Company earned an increase of $440,549 for the three months ended with June 30 and an increase of $871,305 for the six months' period, both net after taxes. Surplus after charges increased $762,327.

The Western States Gas & Electric Company has applied to the California Railroad Commission for authority to have delivered to it by its trustee $15,819 in bonds for money expended for construction work and additions to its plant during June.

The Wisconsin Edison Company reports for June operating revenues of $821,020, an increase of 23.55 per cent over the corresponding period the previous year. Operating expenses were $540,717 and net earnings $280,303, an increase of 18.48 per cent.

Central Illinois Public Service Company has increased its capital stock from $5,000,000 preferred and $5,000,000 common to $7,500,000 preferred and $7,500,000 common, subject to approval by the Illinois Public Service Commission. The increase in the capitalization is a part of a refinancing plan which will retire all floating debt and provide for future financing and expansion of the company and its subsidiaries.

A proposition for the reorganization of the International Power Company of New Jersey, now in the hands of a receiver, has been filed with Chancellor Walker, at Trenton. The hearing was deferred until August 15. The reorganization proposition provides for the raising of $20,000 for the payment of receivership expenses, discharge of the receiver, reorganization of the company under the liberal Virginia laws and dissolution of the New Jersey corporation.

Approval of the new general mortgage of the Northern Ohio Traction & Light Company by the Ohio Public Utilities Commission and the authorization to issue $14,-75,000 bonds under it will enable the company to consolidate all its indebtedness and to provide capital for much new construction. Of the new bonds $12,000,000 are to be used to retire present underlying indebtedness and the remainder for improvements and extensions, which will include $387,000 for double-tracking between Fells and Bedford, $160,000 between Bedford and Newburg, $275,000 between Canton and Massillon, $12,000 for track extensions in Akron, $175,000 for double-tracking the Canton-Akron line between Bluepond and Springfield Lake, $340,000 for double track in Akron, $280,000 for a new high-tension transmission line in the Canton district and $35,000 for the extension of the Mahoning high-tension transmission line to the factory district in Canton. The new bonds will be taken by a syndicate of New York and Cleveland bankers and it is expected that they will be offered in the near future.

Dividends.

	Term	Rate	Payable
Am. Utilities, pf	Q	1.75%	Aug. 10
Ill. Traction, com	Q	0.75%	Aug. 15
Nat. Carbon, pf	Q	1.75%	Aug. 15
So. Cal. Edison, com	Q	1.5 %	Aug. 15
Uni. Pow. & Trans	S	$1.43	July 29
Wash. Ry. & Elec. R. R.	Q	1.25%	Sept. 1

Reports of Earnings.

NORTHERN STATES POWER COMPANY.

	1916	1915
June gross	$ 436,913	$ 369,879
Net after taxes	237,447	195,285
Six months' gross	2,945,357	2,457,746
Net after taxes	1,621,415	1,358,621
Twelve months' gross	5,613,608	4,765,096
Net after taxes	3,132,177	2,637,671

For the twelve months ended June 30

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 31	July 24
American Tel. & Tel. (New York)	129¼	129⅛
Commonwealth Edison (Chicago)	134	145
Edison Electric Illuminating (Boston)	....	237½
Electric Storage Battery common (Philadelphia)	66¾	62½
Electric Storage Battery preferred (Philadelphia)	66¾	62½
General Electric (New York)	169	168½
Kings County Electric (New York)	....	130
Massachusetts Electric common (Boston)	6	5½
Massachusetts Electric preferred (Boston)	36⅝	33
National Carbon common (Chicago)	172	170
National Carbon preferred (Chicago)	123¼	121
New England Telephone (Boston)	134½	134
Philadelphia Electric (Philadelphia)	28⅛	28⅞
Postal Telegraph & Cables common (New York)	....	82
Postal Telegraph & Cables preferred (New York)	....	67½
Western Union (New York)	92⅞	93
Westinghouse common (New York)	57⅞	57¾
Westinghouse preferred (New York)	....	68

there was a net gain of 12,672 or 15.2 per cent in connected customers, the total number of consumers July 1, 1916, being 82,835. The total connected load of the electric properties July 1, 1916, for all purposes increased 22.5 per cent over that of July 1, 1915.

COLUMBIA GAS & ELECTRIC.

	1916	1915
June gross	$ 592,654	$ 537,148
Net after taxes	280,720	247,975
Total income	327,140	285,322
Lease, rentals, etc.	283,700	278,422
Columbia Gas & Electric charges	58,173	57,388
Deficit after charges	14,733	50,488
Six months' gross	4,729,103	4,341,791
Net after taxes	2,482,367	2,243,858
Total income	2,726,768	2,472,744
Lease, rentals, etc.	1,685,410	1,680,776
Columbia Gas & Electric fixed charges	345,505	342,134
Surplus	695,853	449,832

BRITISH THOMSON-HOUSTON.

The annual report of the British Thomson-Houston Company, Limited, for the year 1915 shows very excellent returns. The comparative report for 1915 and 1914 follows:

	1915	1914
Profits after deducting all expenses and charges other than interest on debentures and loans	$1,311,805	$654,340
Amount brought forward	68,990	64,720
Total	$1,380,795	719,060
Interest on debentures and loans	289,610	283,525
Balance	1,091,185	435,535
Transferred to reserves and depreciations	724,390	366,545
Carried forward to new account	*366,795	68,990

*This amount includes provision for the British Government Excess Profits War Tax, which is 60 per cent of the excess profits.

The balance sheet shows due to the General Electric Company of New York, presumably loans and advances, $5,259,405. The capital issued is $4,000,000 of which one-half is in ordinary shares, which have received no dividend, the other half being four-per-cent cumulative preference shares marked "dividend paid to February, 1904." There is also $909,875 in 4.5-per-cent debenture stock and a loan of $100,000 "secured by deposit of part of the shares per contra." Sundry creditors, retentions, etc., stand at $1,503,425, and "sundry debtors, retention moneys and other outstanding accounts" figure on the opposite side at $3,371,860.

PACIFIC GAS & ELECTRIC.

Pacific Gas & Electric Company reported earnings for June, the six months ended June 30 and the twelve months ended June 30 as follows:

	1916	1915
June gross	$ 1,519,517	$ 1,453,960
Net after taxes	653,756	619,741
Total income	678,960	655,367
Surplus after charges	357,517	323,612
Balance after discount	343,086	309,917
Six months' gross	9,341,501	9,203,498
Net after taxes	3,915,142	4,004,155
Total income	4,149,615	4,186,026
Surplus after charges	2,121,006	2,029,181
Balance after preferred dividends	1,436,741	1,482,488
Balance after common dividends	1,012,029	517,451
Twelve months' gross	18,668,304	17,687,873
Net after taxes	7,855,696	7,506,062
Total income	8,322,177	7,836,070
Surplus after charges	4,304,591	3,372,855

REPUBLIC RAILWAY & LIGHT.

Consolidated statement of earnings of Republic Railway & Light Company and subsidiary companies eliminating inter-company items (based upon earnings officially reported by subsidiary companies):

June	1916	1915
Gross	$ 321,024	$ 246,690
Expenses, depreciation and taxes	188,705	*155,947
Net	132,319	90,742
Other income	207	440
Gross income	132,526	91,183
Interest and discount	72,031	55,954
Net income	60,495	35,229
Dividends, preferred stock	26,038	25,957
Balance	34,456	9,272
January 1 to June 30:		
Gross	$1,933,918	1,456,918
Operating expenses, depreciation and taxes	1,143,436	*916,302
Net	790,481	540,616
Other income	1,635	764
Gross income	792,117	541,380
Interest and discount	411,989	332,302
Net income	381,028	209,078
Dividends, preferred stock	156,106	155,742
Balance	224,922	53,336

*Depreciation for 1915 was not carried in operating expenses.

New Incorporations

CORSICANA, TEX.—Davidson Electric Company. Capital, $2,500. Incorporators: C. G. Davidson, M. C. Gaston and J. W. McGill.

WILMINGTON, DEL.—Sterling Electric Company. Capital, $10,000. Manufacture and distribute electrical energy for light, heat and power.

SAN ANTONIO, TEX.—Martin Wright Electric Company. Capital, $30,000. Incorporators: Martin Wright, Phillip Wright and J. G. Cummings.

DOVER, DEL.—The G. H. Swanfeld Company. Capital, $25,000. To manufacture electrical appliances and fixtures. Incorporators: G. Harry and George C. Swanfeld, Philadelphia, Pa., and John L. Burbage, Westmont, N. J.

TRENTON, N. J.—The Pyro Electrical Instrument Company. Capital, $50,000. Manufacture electrical and temperature-measuring instruments. Incorporators: Prof. Edwin F. Northrup, Princeton; Dudley Wilcox, Lawrence; Harry F. Porter, Trenton.

New Publications

GALVANOMETER.—Scientific Paper No. 282 of the Bureau of Standards is entitled "Sensitivity and Magnetic-Shielding Tests of a Thomson Galvanometer for Use in Radiometry," by W. W. Coblentz. This paper describes an investigation made to improve the sensitivity and design of a specialized galvanometer for use in radiometry. By using a lighter suspension in a vacuum, the sensitivity was increased tenfold. The paper gives details as to construction and results of tests.

BUREAU OF STANDARDS.—Scientific Papers Nos. 281, 283 and 284 of the Bureau of Standards, Washington, D. C., are entitled respectively, "A Study of the Inductance of Four-Terminal Resistance Standards," by F. B. Silsbee; "Volume Effect in the Silver Voltameter," by E. B. Rosa and G. W. Vinal; "Constants of Spectral Radiation of a Uniformly Heated Inclosure or So-Called Black Body," by W. W. Coblentz. The first named is of greatest practical interest. It describes precise measurements of the inductances and time constants of low-resistance shunts such as are used for heavy-current work.

Electrical Patents Issued July 25, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,191,940. Ground Terminal Connection for Electric Conductors. W. H. Blood, Jr., Wellesley, Mass. For attaching to pipes, etc. (See cut.)

1,191,968. Auxiliary Control Device for Car-Doors. F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. Door-control circuit interconnected with motor and safety auxiliary circuits.

1,191,973. Vehicle Signaling Device. H. S. Johnson, Madison, Wis., Circuit-controlling mechanism.

1,191,976. Current-Interrupter. C. F. Kettering, assignor to Dayton Engineering Laboratories Co., Dayton, O. Polarized armature and high and low resistance operating coils.

1,192,001. Fishing Apparatus. W. J. Ryan, Sapulpa, Okla. Submarine illuminating apparatus.

1,192,003. Spark-Plug. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Specially shaped electrodes.

1,192,005. Automatic Musical Instrument. E. M. Skinner, Boston, Mass. Electropneumatic.

1,192,006. Electric System. F. M. Slough, assignor to Garford Mfg. Co., Elyria, O. For automobiles.

1,192,007. Telephone System. F. M. Slough, assignor to Garford Mfg. Co. Automatic connection of operator's set.

1,192,034. Clamp or Connector. H. Brisacher, New York, N. Y., assignor of one-half to F. P. Dodge, New York, N. Y. Binding post.

1,192,035. Electric Switch. H. Brisacher, assignor of one-half to F. P. Dodge. Knife-blade.

1,192,040. Safety Appliance for Display Windows. R. R. Courtney, Fort Wadsworth, N. Y. Pressure on shelf closes guard circuit.

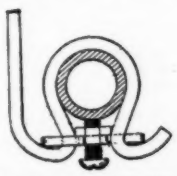
1,192,049. Lamp Globe Attachment. H. S. Evans and W. F. M. Hawe, assignors to Macbeth-Evans Glass Co., Pittsburgh, Pa. Socket attachment for supporting bowl beneath lamp. (See cut, next page.)

1,192,050. Electric Furnace. A. H. Fleming, assignor to National Carbon Co., Cleveland, O. Structure and arrangement of electrodes in arc furnace.

1,192,051. Trolley-Wheel Guard. G. B. Fouts, Alliance, O. Guard fingers over wire removed by pull on trolley rope.

1,192,052. Trolley Switch. G. B. Fouts. Details.

1,192,053. Device for Removing Snow and Ice From Trolley Wires. G. B. Fouts.



No. 1,191,940.—Ground Terminal Connection for Electric Conductors.

Scraper carried by trolley pole ahead of wheel.

1,192,061. Process of Regenerating the Waste Products of Galvanic Batteries. W. Hickman, assignor to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany. Treatment of spent electrolyte and depolarizer.

1,192,062. Process of Making Carbon Articles. A. T. Hinckley, assignor to National Carbon Co., Cleveland, O. Mix contains coke and pitch with ammonium.

1,192,064. Selective Signaling System. J. A. Hulit, assignor to Automatic Electric Co., Chicago, Ill. Polarized device having operating and release magnets and impulse operated.

1,192,086 and 1,192,087. Automatic Train-Stopping Device. J. Marcroft, Providence, R. I. Shut-off valve on locomotive controlled by position of track-side signal and speed of train.

1,192,095. Fraud Detector. H. Muller, Philadelphia, Pa. For cash registers.

1,192,122. Apparatus for Aiding the Hearing. E. W. Schneider, New York, N. Y. Telephone apparatus.

1,192,123. Sound Concentrator for Devices for Aiding the Hearing. E. W. Schneider. Telephonic transmitter has collapsible sound receiver.

1,192,126. Wireless Telegraph Transmitter. A. Shaw, New South Wales, Australia. Uses alternating current from high-potential source, the exciting circuit having a condenser and rectifying spark-gap with gas jet, the radiator being fed on the shock principle.

1,192,150. Connector. E. G. Appleton, assignor to Chicago Fuse Mfg. Co., Chicago, Ill. Clamp for securing conduit to junction box.

1,192,153. Flexible Electric Heater. J. I. Ayer, assignor to Simplex Electric Heating Co., Cambridge, Mass. For electrically heated rug, foot-warmer and the like.

1,192,165. Call-Distributing System. H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Automatic telephone system.

1,192,166. Differential Microphone Repeater. J. J. Comer, assignor to Automatic Enunciator Co., Chicago, Ill. Telephone amplifier.

1,192,171. Controlling System. A. F. Dixon, assignor to Western Electric Co., New York, N. Y. Electromagnetic control of movement of tape.

1,192,175. Selector Switch. A. H. Dyson,

assignor to Western Electric Co. Automatic; for telephone system.

1,192,187. Electric-Light Casing. W. E. Gunther, Omaha, Neb. For housing incandescent lamp.

1,192,210. Railway Safety-Signal System. A. S. Keating, Corry, Pa. Arrangement of circuits and switchboard.

1,192,217. Door Lock and Contact for Electric Elevators. H. P. McCall, Melbourne, Victoria, Australia. Has latch and contact-controlling elevator circuit.

1,192,224. Core for Use in Making Electric Storage-Battery Plates. G. H. Rabenalt, Buffalo, N. Y. For making duplex plates.

1,192,234. System for Controlling Moving Vehicles. P. J. Simmen, Indianapolis, Ind. Speed limited according to track conditions.

1,192,235. Automatic Railroad Block System. P. J. Simmen, Buffalo, N. Y. For single track with sidings.

1,192,258. Throttle Control. H. A. Allen, Willow Creek, Mont. Electromagnetically operated; on steering post of automobile.

1,192,264. Safety Signal for Vehicles. W. N. Best, New York, N. Y., assignor of one-fourth to C. Wupper, Brooklyn, N. Y. Lights at corners of automobile selectively controlled.

1,192,268. Brush-Holder. R. W. Borchard, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Spring-pressed, brush-carrying arms extend in opposite directions from stud.

1,192,270. Telegraph Key. W. A. Boyd, assignor to Western Electric Co., New York, N. Y. Has vibrator for sending dots.

1,192,282. Massaging Tool. C. DeMattia, Detroit, Mich. Electromagnetically vibrated.

1,192,305. Egg-Testing Device. C. P. Heil, Avon, S. D. Arrangement of lamp, circuit, reflector, etc.

1,192,312. Burglar or Detection System. R. M. Hopkins and J. F. D. Hoge, assignors to American District Telegraph Co., Jersey City, N. J. Controlled by sound detectors.

1,192,323. Relay. W. Kaisling, assignor to Kellogg Switchboard Co., Chicago, Ill. Details of device for telephone system.

1,192,346. Electric-Switch Mechanism. B. S. Butts, Erie, Pa. Rotary device operated by series of push buttons in circumference of casing.

1,192,360. Field Rheostat. H. J. Wiegand, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Structural details.

1,192,366. Starting Device for Internal-Combustion Engines. B. Ames, Lowell, Mass. Structure of generator, coupling, etc.

1,192,368. Automatic Circuit-Breaker. A. R. Anderson, Columbus, O. Has automatic reclosing means.

1,192,389. Electrically Heated Implement. A. N. Chandler, Braintree, Mass. Hand-tool holder has removable heating unit.

1,192,393. Current-Converting Apparatus. L. P. Crecelius, Cleveland, O. Brushes rotated on commutator having segments connected to displaced points of resistance in direct-current circuit.

1,192,397. Oil-Switch and Fuse. L. W. Downes and A. W. Faxon, assignor to D. & W. Fuse Co., Providence, R. I. Fuse between movable contacts in oil.

1,192,400. Electrical System for Automobiles. T. A. Edison, Llwellyn Park, West Orange, N. J. For starting and lighting.

1,192,421. Combined Electrical Starter and Transmission Mechanism. W. Hartford, Deal, N. J. Has high-speed, low-voltage starter motor.

1,192,427. Speed-Changing Transmission for Automobiles. M. J. Huggins, New York, N. Y. Electrically controlled.

1,192,447. Switchboard for Electric Circuits. J. J. Neilson, Chicago, Ill. Composite panel.

1,192,453. Device for Testing the Efficiency of a Spark-Plug. J. W. Prasky, Pittsburgh, Pa. Portable device comprising insulating mounting for electrodes applicable to plug.

1,192,457. Resistance Wire for Electric Heaters. R. H. Read, assignor to General Electric Co., Schenectady, N. Y. High resistance core wire in metal tube of same coefficient of expansion and packed with refractory insulating powder.

1,192,468. Electro-Motor Gyroscope. H. W. Shonnard, assignor to Crucible Steel Co., Pittsburgh, Pa. Arrangement of contacts and connections in device having gimbal and non-rotatable inductor.

1,192,477. Electrically Heated Vessel. W. B. Underwood, assignor to W. Castle Co., Rochester, N. Y. Special arrangement of circuit-breaker.

1,192,488. Starting of Alternating-Current Motors. A. Aichele, assignor to Aktiengesellschaft Brown Boveri & Cie, Baden, Switzerland. Arrangement of auto-transformer and choking coils.

1,192,531. Magnet-Actuated Device. F. T. Kitchen, assignor to Compressed Metal Co., New York, N. Y. Details of switch and magnet structure.

1,192,532. Gyroscope. E. Klahn, Weehauken, N. J. Has magnetic driving connection giving freedom of movement to rotating member.

1,192,547. Meter-Testing Cutout. T. E. Murray, Jr., assignor to T. E. Murray, New York, N. Y. Switch and terminal arrangement.

1,192,566. Block-Signal System. W. V. Ryder, Northampton, Mass. Special circuit arrangements.

1,192,585. Electric Display Device. C. Tregining, New York, N. Y. Comprises rotatable wheels with lamps on spokes.

1,192,602. Spark-Plug. C. H. Bond, Philadelphia, Pa. Has fibre insulating-body.

1,192,609. Safety Signal for Balanced Hoists. T. G. Fear, Birmingham, Ala. Controlled jointly by switches at each end of hoist and in hoist house.

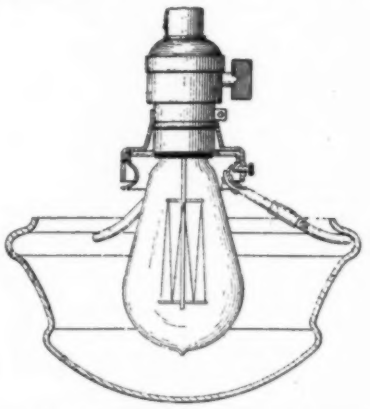
1,192,618. Motor With Rotating Field for Repeating Angular Movements at a Distance Overcoming Great Resistance. R. Girardelli, Rome, Italy. Arrangement of commutator, brushes and connections for polyphase and re-entrant windings on main and auxiliary rotors.

1,192,649. Alternating-Current Motor. M. C. A. Latour, assignor to General Electric Co., Schenectady, N. Y. Special arrangement of compensated series-type motor.

1,192,658. Lamp-House for Projecting Apparatus. E. E. Maggard, Morehead, Ky. Special arrangements for mounting and feeding arc-carbons.

1,192,670. Hardness-Testing Apparatus and Method. R. W. E. Moore and H. E. Edgecomb, assignors to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Has automatic electric control.

1,192,680. Method of Shoeing Permanent Magnets. A. D. Pentz, assignor to General Electric Co. Shoe lugs are squeezed against magnet for sufficient length of time to prevent rebound.



No. 1,192,049.—Lamp-Globe Attachment.

1,192,685. Electrical Signaling System. W. J. Rickets, assignor to A. Graham & Co. and W. J. Rickets, Brickley, England. Step-by-step system.

1,192,687. Inclosed Fuse. H. R. Sargent, assignor to General Electric Co. Structure of end cap and terminal.

1,192,690. Insulator-Supporting Structure. W. Schaake, assignor to Westinghouse Electric & Mfg. Co. Built-up support of pin type facilitating alinement of parts.

1,192,704. Speed Control for Textile Machines. O. Strobe, assignor to General Electric Co. Centrifugal control of driving gear.

1,192,706. X-Ray Tube. E. Thomson, assignor to General Electric Co. Method of increasing capacity and preventing overheating.

1,192,708. Electrical Regulator. A. E. Tirrill, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Vibratory-contact field-regulator.

1,192,710. Exposure Attachment for Cameras. R. Troxell, San Francisco, Cal. Electropneumatic.

1,192,722. Shade Mounting. G. Wright, assignor to General Electric Co. For attachment to socket.

1,192,724. Selective Cutout for Alternating-Current Circuits. P. Ackerman, assignor to General Electric Co. Reverse-current cutout.

1,192,725. Fire-Alarm. W. A. Alcott, Pueblo, Colo. Thermostatically controlled phonograph talks into telephone.

1,192,732. Switch. J. T. Beechlyn, assignor to General Electric Co. Rotary snap-switch comprising dash-pot.

1,192,741. Rectifier. Q. A. Brackett, assignor to Westinghouse Electric Mfg. Co. Mechanical rectifier breaks circuit when counter electromotive force of load and impressed electromotive force are equal.

1,192,749. Automatic Electric-Lamp Lock. D. L. Calahan, assignor of one-third to R. D. Moore and one-third to R. R. Roberts, Fairfax, Wash. Operated by concealed catch.

1,192,759. Vehicle Direction-Indicator. G. A. Genninger, Theresa, Wis. Electromagnetically operated.

1,192,773. Electric Locomotive. G. M. Eaton, assignor to Westinghouse Electric & Mfg. Co. Truck and cab arrangement.

1,192,786. Electric Contact Device. A. A. Kent, Philadelphia, Pa. Interrupter for ignition circuits.

1,192,787. Automatic Spark-Advancing Mechanism. A. A. Kent, Philadelphia, Pa. Has weight-controlled members.

1,192,788. Electric Igniting Mechanism for Internal-Combustion Engine. A. A. Kent, Philadelphia, Pa. Contact device, distributer, governor, etc., yieldingly mounted in casing.

1,192,803. Electrical Illuminated Display Device. J. E. Tucker and A. B. Leech, Los Angeles, Cal. Silhouettes are formed.

1,192,821. Electrical Instrument. F. W. Roller, assignor to Roller-Smith Co., New York, N. Y. Indicating instrument supported by current studs and has face parallel to axis of movable member.

1,192,835. Electric-Line-Apparatus Protector. P. K. Higgins, assignor to F. R. Parker, Chicago, Ill. Heat cartridge.

Reissue 14,173. Waterproof Cap and Shell for Incandescent Electric Lamps. C. A. Vetter, Pittsburgh, Pa. Original No. 1,127,326, Feb. 2, 1915. Manner of securing cap and porcelain core.

PATENTS EXPIRED.

The following United States electrical patents expired on August 1, 1916:

629,792. Electric-Signal System. V. T. Kissinger and A. Trunkel, Chicago, Ill.

629,803. Device for Electrically Lighting or Extinguishing Gas Jets. O. von Morstein, Schoenberg, Germany.

629,819. Apparatus for Automatically Discharging Guns of Warships. J. A. Rowe, London, England.

829,823. Brushholder. S. H. Short, Cleveland, O.

629,837. Motor Control. A. H. Whiting, New York, N. Y.

629,870. Electric Meter. G. C. Pillinger, London, England.

629,872. Electric Motor. J. T. Robson, London, England.

629,897. Arrangement for Starting Alternating-Current Motors. G. Ferraris and R. Arno, Turin, Italy.

629,898. System of Electrical Distribution. G. Fedraris and R. Arno, Turin, Italy.

629,909. Electric Muscular-Exercising Apparatus. A. B. McMillan, New York, N. Y.

629,926. Electric Crane. J. F. Tracy, Pittsburgh, Pa.

629,952. Means for Driving Machines at Variable Speeds by Electric Motors. W. A. Clatworthy, Newcastle-upon-Tyne, England.

629,957. Telephone-Exchange System. G. L. Cragg, Chicago, Ill.

629,978. Coin-Feed Apparatus for Distributing Electric Currents. C. Bieberstein, Charlottenburg, Germany.

629,979. Electric Arc-Lamp. F. Booker, London, England.

630,071. Depolarization Substance for Electric Batteries. G. Platner, Witzenhausen, Germany.

630,076. Electric Switch. J. E. Sayles, Montclair, N. J., and H. E. Reeve, New York, N. Y.

630,113. Electrically Operated Display Turntable. M. Rolle, Philadelphia, Pa.

630,151 and 630,152. Automatic Telegraphy. S. Whitehall, South Bend, Ind.

630,153. Trolley Rail for Electric Roads. W. A. P. Willard, Jr., Hull, Mass.

630,178. Electric Clock. R. Burk, Schroenningen, Germany.

630,205. Electric Motor for Brakes. R. A. J. Evans, Chicago, Ill.

630,210. Trolley Wheel. H. R. Frisbie, Belleville, N. J.

630,223. Regulating Alternating-Current Dynamoelectric Machines. M. Hutin and M. Leblanc, Paris, France.

630,280. System of Electrical Distribution. G. T. Woods, New York, N. Y.

630,283. Method of and Apparatus for Utilizing Waste Gases and Heat from Electric Furnaces. Wilhelm Brothers, Aix-la-Chapelle, Germany.

630,292. Electric Switch and Alarm. G. W. MacKenzie, Beaver, Pa.

Design 31,315. Battery-Plate Separator. H. C. Porter, Chicago, Ill.

Design 31,316. Electrical Terminal. W. B. Bragdon, Cumberland Mills, Me.

Design 31,317. Incandescent Electric Lamp. H. J. Jaeger, New York, N. Y.